THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: EXPERIMENTAL STUDY OF THE EFFECTS OF A FAVORABLE PRESSURE GRADIENT

By

H. L. JULIEN, W. M. KAYS and R. J. MOFFAT

Report No. HMT-4

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for
THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Thermosciences Division
Department of Mechanical Engineering
Stanford University
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ABSTRACT

Mean velocity profile data are reported for blown, unblown, and sucked accelerated boundary layers. The pressure gradients investigated are those corresponding to constant values of the pressure gradient parameter $K = \frac{\nu}{U_\infty^2} \frac{dU_\infty}{dx}$. The three values of K considered are 0.57×10^{-6}, 0.77×10^{-6}, and 1.45×10^{-6}. For each pressure gradient, the surface boundary conditions c ver a range of constant blowing and sucking fractions from $F = -0.004$ to 0.006.

The friction factor was found to be decreased by the imposed acceleration for suction, whereas for blowing an increase was indicated. This is based upon a comparison with zero pressure gradient data for equivalent local momentum thickness Reynolds number and blowing parameter B.

Velocity profiles corresponding to these accelerated flows were found to deviate from those characteristic of zero pressure gradient flows. These deviations in the fully turbulent and wake regions of the boundary layer apply over the range of blowing and sucking fractions investigated.

For boundary layers where local momentum thickness Reynolds number is invariant in the flow direction, velocity distributions near the wall were found to be similar in U^+ vs y^+ coordinates. In the exceptional cases where similarity was not observed, substantial structural changes in this region are suggested.

The corresponding velocity distributions far from the wall were found to attain similarity in U/U_∞ vs y/δ coordinates and velocity-defect coordinates. These outer region coordinate systems are equivalent in these cases, as a result of the relative constancy of friction factor in the flow direction.

Unique values of local momentum thickness Reynolds number, Re_{δ_2} , and shape factor, H , were found to be associated with these boundary layers for given value of the parameter K and blowing or sucking fraction F .

Semi-empirical representations of these data in the form of simple Prandtl mixing length distributions are presented. The inner regions of the layer are represented by means of a two-layer model and a continuous model. The outer regions are represented by an appropriate truncation of these distributions.

Utilizing the resulting eddy-diffusivity relations in a finite-difference procedure, predictions of the present data were obtained. Agreement with the data is found to be acceptable for most engineering purposes.

TABLE OF CONTENTS

Page

Page

LIST OF FIGURES

Figure		Page
18	U^+ vs. y^+, $F = 0.004$ and $K = 1.45 \times 10^{-6}$, run 82068	66
19	U^+ vs. y^+, $F = -0.002$ and $K = 0.57 \times 10^{-6}$, run 52868	67
20	U^+ vs. y^+, $F = -0.002$ and $K = 1.45 \times 10^{-6}$, run 80768	67
21	U/U_∞ vs. y/δ, $F = 0.0$ and $K = 0.57 \times 10^{-6}$, run 51468	68
22	U/U_∞ vs. y/δ, $F = 0.0$ and $K = 0.77 \times 10^{-6}$, run 51568	68
23	U/U_∞ vs. y/δ, $F = 0.0$ and $K = 1.45 \times 10^{-6}$, run 73068	69
24	U/U_∞ vs. y/δ, $F = 0.004$ and $K = 0.57 \times 10^{-6}$, run 41268	70
25	U/U_∞ vs. y/δ, $F = 0.004$ and $K = 1.45 \times 10^{-6}$, run 82068	70
26	U/U_∞ vs. y/δ, $F = -0.002$ and $K = 0.57 \times 10^{-6}$, run 52868	71
27	U/U_∞ vs. y/δ, $F = -0.002$ and $K = 1.45 \times 10^{-6}$, run 80768	71
28	Comparison of $Re_{\delta_2}\big\vert_{Asymp.}$ with turbulent and laminar predictions for unblown boundary layers	72
29	Asymptotic values of Re_{δ_2} vs. K	73
30	Comparison of Simpson's shape factor correlation with data	73
31	Dimensionless shear stress profiles for $K = 0.57 \times 10^{-6}$	74
32	Dimensionless shear stress profiles for $K = 1.45 \times 10^{-6}$	74
33	Velocity profiles for cases of suction at wall	88

Figure		Page

Figure		Page

NOMENCLATURE

A_*	function in modified Van Driest mixing length correlation
B	blowing parameter; $\frac{\dot{m}''}{(\rho U)_\infty (\frac{C_f}{2})}$
$C_f/2$	friction factor; $\frac{C_f}{2} = \frac{g_c \tau_w}{\rho_\infty U_\infty^2}$
C_p	probe viscous correction
c_p	specific heat at a constant pressure, Btu/lbm °F
exp	base of natural logarithms
F	blowing fraction; $F = \frac{\dot{m}''}{(\rho U)_\infty}$
H	profile shape parameter; $H = \frac{\delta_1}{\delta_2}$
h	heat transfer coefficient, Btu/sec ft^2 °F
K	local pressure gradient parameter; $K = \frac{\nu}{U_\infty^2} \frac{dU_\infty}{dx}$
k_w	surface roughness size, inches
ℓ	Prandtl mixing length defined by $\tau = \rho \ell^2 \left\lvert\frac{\partial U}{\partial y}\right\rvert \frac{\partial U}{\partial y}$
$\dot{m}''$	surface mass flux, lbm/sec ft^2; $\dot{m}'' = (\rho V)_w$
P	pressure; static pressure if not subscripted
p^+	pressure gradient parameter; $p^+ = \frac{g_c \mu_w}{\rho_w^2 U_\tau^3} \frac{dP}{dx}$

Q	denotes a function
Re_p	Reynolds number based on hydraulic diameter of probe mouth
Re_x	Reynolds number based on position along the plate, $\frac{U_\infty X}{\nu}$
Re_{δ_2}	Reynolds number based on momentum thickness, $\frac{U_\infty \delta_2}{\nu}$
R_x	Integrated X-Reynolds number; $R_x = \int_0^x \frac{U_\infty}{\nu} dx$
St	Stanton number, $\frac{h}{(\rho U)_\infty c_p}$
T	temperature, ^oR
t	temperature, ^oF
U	velocity in the mainstream direction, ft/sec
U^+	dimensionless velocity; $U^+ = U/U_\tau$
U_τ	shear velocity; $U_\tau = \sqrt{\tau_w g_c/\rho_w}$, ft/sec
u'	mainstream fluctuation velocity, ft/sec
V	velocity perpendicular to the wall, ft/sec
V_w^+	dimensionless blowing velocity; $V_w^+ = V_w/U_\tau$
X,x	distance along the plate in the flow direction, inches
y	distance along a line perpendicular to the plate, inches; $y = 0$ at plate surface

y^+	dimensionless distance; $y^+ = \frac{yU_\tau}{\nu}$
$\tilde{y}^+$	dimensionless distance based on local shear stress; $\tilde{y}^+ = y^+\sqrt{\tau^+}$
z	transverse distance across the plate, inches; the X, y, and z directions are a left-handed set
a,b,c, d,m,n	denote constants
β	"equilibrium" parameter; $\beta = \frac{\delta_1}{\tau_w}\frac{dP}{dx}$
Δ_2	enthalpy thickness of the boundary layer; $$\Delta_2 = \int_0^\infty \frac{\rho U}{\rho_\infty U_\infty}\left(\frac{t_\infty - t}{t_\infty - t_w}\right) dy$$
δ	boundary layer thickness; y at $\frac{U}{U_\infty} = 0.99$
δ_1	displacement thickness; $$\delta_1 = \int_0^\infty \left(1 - \frac{\rho U}{\rho_\infty U_\infty}\right) dy$$
δ_2	momentum thickness of the boundary layer; $$\delta_2 = \int_0^\infty \frac{\rho U}{\rho_\infty U_\infty}\left(1 - \frac{U}{U_\infty}\right) dy$$
κ	Von Kármán constant
λ	function utilized in truncation of mixing length distribution
μ	dynamic viscosity, lbm/sec ft

ν	kinematic viscosity, ft^2/sec
ρ	density, lbm/ft^3
τ	shear stress, lb_f/ft^2
τ^+	dimensionless shear stress; $\tau^+ = \frac{\tau}{\tau_w}$

Subscripts

a	denotes position at which pressure gradient is imposed
c	denotes critical position at which viscous sublayer "effectively" ends in two-layer model
o	static condition; o also refers to unblown, unaccelerated state
p	denotes profile estimate
St	denotes estimate based on Stanton number data
s	stagnation condition
t	denotes turbulent contribution
w	wall condition
∞	free-stream condition
*	refers to modified Van Driest model

CHAPTER I

INTRODUCTION

The turbulent boundary layer with non-zero normal velocity V_w at the surface is of practical interest since injection and suction of fluid at a surface are utilized for thermal protection and boundary layer control, respectively. In most of these applications, the mainstream fluid is locally accelerated or decelerated; hence, the combined effects of transpiration at the surface and acceleration of the main flow must be considered in system design.

Since there is no adequate theory for shear flow turbulence, existing turbulent boundary layer "theory" relies heavily on experimental results. Well documented velocity measurements are necessary to extend the theory so that these combined effects are properly represented.

The present investigation is concerned with the fluid dynamics of accelerated turbulent boundary layers with injection or suction of fluid at the surface. Experiments are restricted to boundary layers characterized by constant values of the acceleration parameter $K \left(K = \frac{\nu}{U_\infty^2} \frac{dU_\infty}{dx} \right)$ and blowing fraction $F \left(F = \frac{(\rho V)_w}{(\rho U)_\infty} \right)$. The specific flows considered are further characterized as: two-dimensional, constant property flow over a uniformly permeable surface, where the pore opening and pore spacings are small enough to insure an aerodynamically smooth surface with uniform injection or suction.

A. Review of Previous Experimental Works

In recent years a number of experimental hydrodynamic investigations have been concerned with blown ($V_w > 0$) and

sucked ($V_w < 0$) turbulent boundary layers [1-17]. Only two of these investigations are known to consider the effects of acceleration of the main flow. Experimental hydrodynamic investigations of accelerated boundary layers on impermeable surfaces have also been reported [18-24]. Results of these experiments relevant to the present study are briefly discussed.

A.1. Cases of constant free-stream velocity with transpiration

Simpson [17] presents a detailed review of the experimental investigations, up to 1967, in the case of zero pressure gradient. The reader is referred to this review which will not be repeated here.

The experimental data of Simpson, obtained on the same apparatus as used for the present investigation, are believed to represent a reliable and consistent set of hydrodynamic data covering the widest range of both blowing and sucking conditions. These data are also documented in a manner sufficient for purposes of comparison and correlation with the present data. As a result, these data and associated correlations proposed by Simpson are utilized in the present study.

A.2. Accelerating flows without transpiration

The relevant experimental investigations of accelerated flows on impermeable surfaces may be categorized as: 1) mild pressure gradient flows of the turbulent "equilibrium" type, or 2) strong pressure gradient flows where the onset of relaminarization is of major concern.

The experiments of Herring and Norbury [18] represent one of the major contributions in mild pressure gradient turbulent boundary layer investigations. Velocity-defect distributions for accelerated boundary layers were established corresponding to values of the dimensionless pressure gradient

parameter $\beta(\beta = \delta_1/\tau_w \, dP/dx)$ of -0.35 and -0.53 . These velocity-defect profiles are shown to be similar in the outer regions of the layer, as previously proposed by Clauser [25]. Their data agreed well with the theoretical predictions of Mellor and Gibson [26], which are based upon "equilibrium" theory. It is shown in section B of this chapter that the unblown asymptotic boundary layer flows considered in the present study are also constant β flows where $\beta < -0.5$. These findings suggest that "equilibrium" theory might possibly extend to the strongly accelerated flows presently considered.

The experiments of Launder et al. [19-21] have been concentrated in the area of strongly accelerated boundary layer flows. The major concern in these investigations has been to determine the onset of relaminarization. The majority of the investigations of Launder et al. were concerned with constant K accelerations, shown to be an important parameter by several studies. The thermal measurements made by Moretti and Kays [27] for strong, constant K , accelerated flows indicate very substantial decreases in Stanton number which could be roughly correlated with the parameter K . In concurrent studies made by Kline, Reynolds, Schraub, and Runstadler [22] it was demonstrated that the burst frequency of turbulent disturbances originating at the wall also correlated with the parameter K .

Launder and Stinchcombe [20] studied constant K accelerations where the local momentum thickness Reynolds number, Re_{δ_2} , approached an asymptotic limit. It was observed that the velocity profiles were similar in such a boundary layer for values of $K = 0.7 \times 10^{-6}$, 1.25×10^{-6} and 3×10^{-6} . Velocity profile similarity is predicted by the exact laminar solution* for constant K accelerations,

*The reader is referred to reference [28] for a statement of indicated laminar solution.

suggesting similarity through values of K corresponding to complete relaminarization. Profiles for these strongly accelerated flows are shown to differ from those corresponding to turbulent boundary layer flow over an impermeable flat plate. As K was increased, a continuous shift from a typical turbulent profile was exhibited. This shift is characterized by an "overshoot" of the velocity profile from that corresponding to the "law of the wall" and a simultaneous decrease of the wake region. Later experiments of Launder and Jones [21] do not corroborate the quantitative results of Launder and Stinchcombe even though performed on the same apparatus, but the same qualitative conclusions were found to apply. This profile "overshoot" is consistent with the findings, presented in reference [22], that a decrease in the burst rate of turbulent disturbances originating at the wall is associated with an increase in K, resulting in a reduction of turbulent fluctuations at the wall.

The experiments of Badri Naroyanan and Ramjie [23], concerned with both constant and variable K flows, demonstrate the same profile "overshoot" behavior.

The experiments of Patel and Head [24] were concerned with boundary layer flows for which K was strongly varying. The characteristics observed in the initial adjustment of the layer to the imposed pressure gradient are noteworthy. For accelerations where the parameter K is increasing in the flow direction, the profiles are shown to initially "undershoot" the "law of the wall" and then approach the previously observed "overshot" appearance in a continuous development. Although corroborative experimental data is not known to exist, this behavior is thought to be indicative of the inability of similarity data to adequately represent boundary layer flows in which K is strongly varying. Nonsimilar flows of this type are of importance, but are not treated in the present study.

A.3. Accelerating flows with transpiration

The characteristics found in accelerated boundary layers on impermeable surfaces will undoubtedly be present when blowing or suction at the surface is introduced. In the work of Simpson [17], the effects of transpiration in zero pressure gradient flows are shown to be quite substantial in terms of order of magnitude reduction in friction factor with blowing and corresponding increases with suction. Mean profile appearances are also shown to significantly deviate from those of flow over an impermeable flat plate; upward shifts of the velocity profile from the "law of the wall" with blowing and downward shifts with suction are indicated. Although these characteristics associated with transpiration are also expected in the combined case, any successful attempt to represent the boundary layer characteristics would be only fortuitous if based on data where each effect has been isolated.

Only two experimental works are known to exist where the combined case was investigated. Each considered only blown layers and an insufficient amount of experimental data to adequately represent the boundary layer characteristics.

Romanenko and Kharchenko [7] present friction factor and Stanton number data but no profiles of velocity or temperature. Insufficient documentation of the conditions under which these data were obtained in the combined cases, including a specification of the free-stream velocity distribution, prevents its utilization in the present study.

In the experiments of McQuaid [10], friction factors were not measured in the two combined blowing and acceleration runs made. This presents a restriction on the formulation of data correlations. Utilizing friction factors corresponding to Stevenson's inner law [29], McQuaid was able to predict momentum thickness distributions which agreed well with the experimentally determined distributions. Although this agreement is found to exist, this is considered not to be a

sensitive test of friction factor when blown boundary layers are considered.

It is concluded that a need still exists for a complete set of documented data for the combined case, where friction factors are accurately known.

B. Description of Asymptotic Boundary Layer Flow

The asymptotic boundary layer flows considered in the present study are characterized by acceleration at a constant value of K and transpiration at a constant value of F . To illustrate the necessity of these boundary conditions, the two-dimensional momentum integral equation can be presented in the form

$$\frac{dRe_{\delta_2}}{dR_x} = \frac{C_f}{2} - Re_{\delta_2}(H+1)K + F \tag{I-1}$$

where $$dR_x = \frac{U_\infty}{\nu}\,dx$$

For constant values of K and F , the boundary layer develops such that the terms on the right-hand side of equation (I-1) balance, forcing the derivative $\frac{dRe_{\delta_2}}{dR_x}$ to zero. Such a boundary layer will be classified as asymptotic in the regime where Re_{δ_2} is maintained constant. Note that this condition requires a constant friction factor C_f for similar profile development.

These asymptotic flows are also constant β flows in the event similar profiles exist. For zero blowing, substitution of the asymptotic form of equation (I-1) into the definition of β yields

$$\beta = -\frac{H}{H+1} \; . \tag{I-2}$$

The data of Launder and Stinchcombe [21] show the existence of similar profiles for asymptotic accelerated boundary layers where equation (I-2) indicates that these are constant β flows where $\beta < -0.5$.

The present study is restricted to these asymptotic boundary layers for purposes of convenience. For asymptotic or near-asymptotic flows, equation (I-1) yields one method of estimating friction factor, where the derivative, $\frac{dRe_{\delta_2}}{dR_x}$, represents a correction to the asymptotic form of equation (I-1). This is a desirable characteristic since the direct measurement of friction factor is not available on the present apparatus. When the friction factor remains constant these flows are also characterized by constant values of the blowing parameters B and V_w^+, as well as p^+. These characteristics are desirable in the formulation of data correlations.

C. Objectives of the Present Research

The motivations for the present research can be summarized as follows. Turbulent boundary layer theory is heavily dependent upon the results of experimental studies where specific effects have been isolated. Several experimental investigations have been reported where the effects of transpiration and the effects of strong acceleration of the main flow are considered independently. The few experimental investigations where the combined effects have been studied are insufficient to represent the boundary layer characteristics resulting from the coupling of these effects.

The overall objective of the present work is to investigate and record the fluid dynamic behavior of the turbulent boundary layer where the combined effects of transpiration and acceleration are present. The range of blowing, suction, and acceleration considered is that covering most practical

applications where turbulent boundary layer theory is appropriate. The following subdivisions of this objective are:

1. To tabulate and document mean velocity profile data taken on the Stanford Heat and Mass Transfer Apparatus.
2. To obtain skin friction results from the mean velocity profiles and estimate the reliability of these data.
3. To examine the mean velocity profiles for development and similarity characteristics in asymptotic boundary layer flows.
4. To obtain semi-empirical representations of these results in the form of simple "equilibrium" eddy-diffusivity models.
5. To incorporate the resulting eddy-diffusivity relations into a finite-difference procedure that will analytically reproduce the experimental data and provide a basis for prediction of situations not covered by the experiments.

In the chapters to follow, the fluid dynamic characteristics of the present apparatus are briefly described as well as the velocity profile instrumentation. Then the experimental velocity profiles are presented, and data necessary to describe the conditions under which they were obtained are documented. Finally, the indicated eddy-diffusivity relations and the resulting predictions of the present experimental data are presented.

CHAPTER II

EXPERIMENTAL APPARATUS

A. Brief Description of the Apparatus*

The apparatus used in the experiments consists of a 24-segment porous plate, 8 feet long and 18 inch wide. The plate forms the lower surface of a test duct of rectangular cross-section, 20 inches wide and 6 inches high at the inlet end of the duct. The upper surface is adjustable to achieve the desired velocity distribution along the duct. The 1/4-inch thick plates are smooth to the touch and are uniform in porosity within ±6 percent in the six inch span centered on the test duct centerline, where velocity profiles are taken. Separate mainstream and transpiration blowers provide the system with air, while heat exchangers are used to control air temperature.

Conventional temperature and flow rate instruments were used to control the operation of the apparatus. Mean velocity profiles were taken with stagnation pressure probes and manual traversing equipment. The probes used for boundary layer surveys have a flattened mouth 0.012 inch by 0.035 inch. The dynamic pressures were measured with calibrated inclined manometers. The probes were attached to traversing instruments fastened to a rigid support frame. These spring-loaded micrometer-driven instruments provide for the change and measurement of the probe distance from the test wall.

B. General Physical Arrangement

The Heat and Mass Transfer Apparatus is a two-story facility with the operating controls and heavy hardware

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*A complete description of this apparatus is contained in references 17, 30, and 31.

on the ground level, and the test section on the second floor of a 15-foot tower. The first floor operating area is approximately 10 by 12 feet, as is the deck comprising the second floor. Photographs of the operating console area, and of the test section area, are shown in Figures 1 and 2, respectively.

The objective of the apparatus is to provide and control three general systems: main air stream over the test plate, transpiration air through the test plate, and electric heater power to the test plates. This is accomplished by the system shown schematically in Figure 3, the Test Apparatus Schematic.

Those characteristics of the air systems relevant to the reliability of the present experimental data are briefly discussed.

B.1. Main air system

The flow path of the main air stream is as follows: (1) inlet air filter, (2) mainstream flow control valve, (3) main blower, (4) mainstream heat exchanger, (5) screens, (6) plenum chamber and primary nozzle, (7) test section. This system provides a velocity of approximately 44 ft/sec at the primary nozzle exit at full flow.

The heat exchanger located at the upstream end of the nozzle acts as a flow straightener, as well as a means of control on the air temperature. Measurements taken by Moffat [30] in the entrance end of the test section show that the temperature is uniform within 0.25 ^{o}F, under usual operating conditions, in the core of the mainstream.

The plenum chamber and primary nozzle provide a two-dimensional contraction from the heat exchanger to the test section. The area ratio is 4:1, and the nozzle is designed for uniform acceleration of the flow to yield a uniform velocity profile at the entrance to the test section. Boundary layer suction is not used on this apparatus.

Initially, a 70-mesh brass screen covered the flow area downstream of the heat exchanger. It was later found

necessary to replace this screen with a double screen system, to attain a more uniform boundary layer development within the nozzle for the strongest pressure gradient flows investigated. The double screen system consists of a single 100-mesh and a single 50-mesh screen separated 3/4 inch from one another.

A trip, of 3/8-inch wide 50(1) coarse grid carborundum garnet paper, is located at the exit edge of the transition section joining the nozzle to the test section. The trailing edge of the trip is located 1/8 inch upstream of the porous test section. When the double screen system was installed, an additional trip was fastened to the lower wall of the nozzle 17 inches upstream of the porous test section. The new trip consists of a 1/16-inch high by 1/4-inch wide bakelite trip and it was positioned to aid in the development of a uniform turbulent boundary layer at the trailing edge of the downstream trip, with a minimal momentum thickness. Each trip is extended the full width of the duct.

The test section consists of three plexiglass pieces: two side walls, fastened to the test plate structure, and an adjustable upper surface. Different top covers are available to accommodate different free-stream velocity and blowing (or sucking) distributions.

B.2. Transpiration system

The flow path of the transpiration system is as follows: (1) inlet air filter, (2) transpiration blower, (3) transpiration flow heat exchanger, (4) transpiration flow header, (5) flow meter bank, (6) delivery tubes to the individual plate sections.

The transpiration heat exchanger allows control of the transpiration air temperature. Operating the entire transpiration header system at a uniform temperature equal to the ambient temperature prevents heat transfer between the

transpiration system and the ambient environment. A single temperature measurement in the entrance of the header is then sufficient to determine the temperature of the flow through all twenty-four flowmeter systems fed from the header. Traverses across the delivery duct, at the entrance to the header, have shown that the temperature there is uniform within 0.3 ^{o}F; consequently, a single point temperature measurement is representative of the flow condition.

The rig can be converted from blowing to suction by a reversal of the twenty-four connecting tubes and blower connection. There is no temperature control in the suction mode, but none is needed due to the high heat exchanger effectiveness of the riser tubes. This results in all suction air being brought essentially to room temperature before it reaches the flowmeters.

All tube and hose connections were carefully inspected for leakage to insure measurement of flow through each plate was that through the associated flowmeter.

C. The Porous Plates and Test Plate Assembly

The porous plates used in this apparatus are made of sintered bronze material. They have the following characteristics:

1. Overall dimensions: 18.0 x 3.975 x 0.25 inches
2. Porosity: approximately 40 percent
3. Porosity and flow rate uniformity: within ±6 percent in the center 6-inch span
4. Surface roughness: maximum of 200 microinches (RMS) measured with a stylus of radius 0.0005 inches
5. Particle shape: spherical (estimated 99 percent of particles)

6. Particle sizes: maximum diameter 0.007 inches, minimum 0.0023, average diameter 0.005 inches.

No requirement exists that all plates have the same porosity, simply that each plate be uniform across the center 6-inch span. In actual use, the transpiration flow rate is individually measured for each plate in the apparatus, and ample pressure is provided by the transpiration blower to take care of porosity differences from one plate to another.

The test plate assembly forms the bottom surface of the test section. It is 20 inches wide and 96 inches long in the flow direction. It is made of four subassemblies bolted to a common support structure. Each subassembly consists of an aluminum casting accommodating 6 individual porous plates.

A cross-section view of a typical compartment in the test plate assembly is given in Figure 4. The use of pre-plates and honeycomb on the underside of each plate was found necessary to insure a uniform temperature in the air flowing through each plate. Five thermocouples are embedded in each plate to measure the surface temperature.

Porosity mappings of each plate were obtained by Moffat [30]. These mappings are used to calculate that fraction of the flow which passed through the center span of each plate. Small corrections based on energy balance runs made during thermal investigations are also applied to each plate.

Variations in the transpiration mass flux through each plate due to static pressure variations in the main air stream were found to be negligible in the present study. The largest pressure drop across the span of any plate, due to the main flow acceleration, is on the order of 10 percent of the pressure drop through the plate at the lowest blowing fraction of 0.001. For each static pressure distribution in the present experiments, thermal gradients, other than those observed by Moffat in zero pressure gradient flows, were

found not to exist in the plates when they are uniformly heated and blowing or suction is applied.

D. Instrumentation

The instrumentation used in the present experimental study is briefly described here.

D.1. Temperature

All measurements of gas temperature were made with calibrated iron-constantan thermocouples described in detail in reference [30]. Temperature measurements relevant to this fluid dynamic study include free-stream static, porous plate, flowmeter, and ambient temperature.

D.2. Injection and suction flow rates

There are two flowmeters with different ranges for each of the twenty-four individual test plates. The meters, Fisher-Porter B4-27-10 and B5-27-10 Rotameters with float types BSVT-45-A and BSVT-64-A, respectively, provide measurement from 0.5 to 18.0 scfm per channel. Factory calibrations for these meters were checked against laminar flow elements, and against ASME orifice units. Agreement between these calibrations and the factory furnished calibration curves was found to be within the accuracy of the test calibration; hence, the factory curves were used in all data reduction. Downstream of each flowmeter pair is a U-tube mercury manometer, measuring rotometer discharge pressure for the density correction to the indicated flow.

D.3. Pitot probes

Three types of probes were used in the present investigation: flattened mouth pitot probes, Kiel probes, and Pitot-Prandtl probes.

The flattened mouth pitot probes were used for all boundary layer traverses. They are identical to those

utilized by Simpson [17] for this purpose and are described in detail by Simpson. Typical characteristics of these probes are

1. Probe mouth dimensions: 0.012 inch by 0.035 inch

2. Tube wall thickness: 0.0025 inch

3. Yaw and pitch plateaus: ± 10 degrees

D.4. Static pressure ports

Static pressure taps are located at 2 inch intervals along one side wall of the test section. They are spaced approximately 1 inch above the porous test surface so that they remain below the top cover for all test runs made in the present study. They are 0.040-inch diameter square-edged holes flush with the side wall with 1/8-inch O.D. brass tube hose connectors. According to Rotem [32], the static pressure error incurred by these taps, due to wall shear effect, is estimated to be about 0.0001 inches of water.

These side wall taps were tested against the static pressure readings from Pitot-Prandtl probes located at the centerline of the test section. The static pressure ports of the probes were aligned with the side wall tap and then traversed through the mainstream potential core. These tests were made with and without transpiration and for different upper wall settings to check for corner effects in the duct and streamline curvature in the potential core of the main air stream, respectively. The static pressure sensed by the Pitot-Prandtl probes was found to agree with that sensed by the side wall tap within 0.002 inches of water for all upper wall settings used in the present study. All present data were taken using the side wall pressure taps.

D.5. Pressures

Dynamic pressures were measured with four Dwyer model no. 100.5 inclined manometers with mirror scales,

reading directly in inches of water (-0.1 to 1.0) at 75 ^{o}F . Each manometer was periodically calibrated against a Harrison micromanometer, indicating a difference of no more than 0.002 inches of water with 0.001 being the common value.

D.6. Distances

Each probe was positioned relative to the porous wall with an individual traversing mechanism. These traversing mechanisms were mounted on a rigid support frame bolted to the structure supporting the test plate assembly. The longitudinal position of each traversing mechanism relative to a reference mark on the support frame is determined by means of spacers. Corrections were made for the longitudinal position of the probe mouth with respect to the traversing mechanism, yielding the distance from the beginning of the test section to the probe mouth.

The micrometer-driven traverse mechanisms allow the probe to be advanced toward or away from the porous wall, with accurate alignment of the probe mouth in the flow direction. Although the least count is 0.001 inch, it was found that the micrometer could be advanced repeatedly to within 0.0002 inch, providing the micrometer was always advanced in the same direction to eliminate backlash.

A more complete description of the traversing mechanism and the associated support frame is contained in reference [17].

E. Qualification of the Apparatus

E.1. Summary

Velocity profile data taken on the apparatus were found to be "normal" and acceptable for incompressible flow over the impermeable flat plate for the range of free-stream velocities encountered in the present pressure gradient runs. Less than 3/8 percent variation was found in the velocity in

the potential core. Discrepancies in experimental results using the two-dimensional energy integral equation were maintained on the order of the experimental uncertainty of these data, suggesting that if three-dimensional flows exist in the present experiments they are weak.

The test surface was found to be aerodynamically smooth for all impermeable flat plate data examined for the range of free-stream velocities indicated.

It appears that the test surface is aerodynamically smooth for all blowing, suction, and acceleration conditions investigated.

E.2. Friction factors and mean velocity profiles for the impermeable flat plate

Although pressure gradient flows are the major concern in the present study, the apparatus should produce acceptable impermeable flat plate data at the free-stream velocity levels encountered. The two requirements considered are:

1. The generally accepted correlation of friction factors

$$\frac{C_f}{2} = 0.0128 \, Re_{\delta_2}^{-1/4} \qquad \text{(II-1)}$$

   should be satisfied, as it was in the experiments of Simpson [17].

2. The profiles should exhibit wake strengths corresponding to those considered "normal" by Coles [33].

Impermeable flat plate runs were made at free-stream velocities of 42,86, and 126 ft/sec, respectively. An acceleration of the flow preceded the region where the free-stream velocity was maintained constant. Comparison of the present data for $U_\infty = 42$ ft/sec with that of Simpson at the same level of free-stream velocity indicates that the effect of this initial acceleration is negligible. Figure 5 shows

the comparable agreement of these data with the friction factor correlation given by equation (II-1). The corresponding U^+ vs y^+ profiles are also shown to be in agreement with the accepted "law of the wall" in Figures 6 and 7.

Friction factors were obtained for these impermeable flat plate runs using a momentum integral equation method, described in Chapter III. Here, the concept of a "virtual" origin is utilized. The "virtual" origin is defined as that location from which the boundary layer appears to have begun assuming a uniform turbulent behavior everywhere. The "virtual" origin was calculated for each profile utilizing the relation

$$\frac{\delta_2}{X} = 0.037 \, Re_x^{-0.2} \qquad \text{(II-2)}$$

This variation of δ_2 with X agrees with the friction factor correlation given by equation (II-1). The maximum percentage deviation of the "virtual" origin locations, corresponding to all profiles for a given test run, is ± 3 percent. Friction factors were obtained by means of a power fit to the experimental Re_{δ_2} vs Re_x variation, with X measured from the "virtual" origin location corresponding to the upstream profile for each test run. These friction factors are compared with equation (II-1) in Figure 5, where the maximum deviation of the data from this relation is shown to be ± 7 percent. Inasmuch as the experimental uncertainty of these data is approximately ± 5 percent, this agreement is considered acceptable for the purposes of the present study.

Figures 6 through 9 show the mean velocity profile data in wall coordinates (U^+ vs y^+). With the exception of the run for U_∞ = 126 ft/sec, the logarithmic region of the profiles is best fitted by

$$U^+ = \frac{1}{0.44} \ln|y^+| + 5.55 \qquad \text{(II-3)}$$

This uses the mixing length constant and intercept as proposed by Simpson. The result of using the values proposed by Coles [33] is also presented for purposes of comparison. The data for $U_\infty = 126$ ft/sec lie below both of these relations due to experimental uncertainties in $C_f/2$ and possible surface roughness (see further discussion of surface roughness below).

Denoting the maximum deviation $\frac{\Delta U}{U_\tau}$ from equation (II-3) as the Strength of the Wake, Coles [33] classified boundary layers as "normal" if their wake strength is within ± 20 percent of values given by the empirical relation

$$\frac{\Delta U}{U_\tau} = 2.65\left[1-\exp\left(\frac{-(Re_{\delta_2}-500)}{850}\right)\right] \qquad \text{(II-4)}$$

for $Re_{\delta_2} > 500$. This criteria results from Coles classification of nearly 500 impermeable flat plate profiles observed by independent investigators.

The unblown flat plate data in the present study was tested for the Strength of the Wake. Using the log region fit given by equation (II-3), the Strength of the Wake values, given on Figures 6 through 9, are within ± 10 percent of values predicted by equation (II-4). This agreement is similar to that observed by Simpson and, hence, the present impermeable flat plate data is considered "normal" and acceptable.

E.3. Mainstream conditions

Differential traverses made by Moffat [30] at axial locations along the duct show that, within the potential flow core, the velocity variation is less than 3/8 percent across any one plane. These measurements were made with the single screen system and no larger deviations were measured after the installation of the double screen system.

With the single screen system, hot wire anemometer measurements indicated a free-stream turbulent intensity $\sqrt{\overline{u'^2}}/U_\infty$ of 1.2 percent for U_∞ = 44 ft/sec. The double screen system reduced this intensity level to 0.8 percent for U_∞ = 44 and 25 ft/sec. A spectral analysis of this fluctuation data showed substantial contributions at the blower frequency (55 cps) and higher harmonics of this frequency. These may reflect the coupling of the blower noise to the tunnel system rather than a typically random turbulent fluctuation in velocity. Turbulence levels of 1 percent or more would normally result in distortions of the profiles from the "normal" shapes described by Coles [33].

E.4. Two-dimensionality of boundary layers

A unique method of determining the degree of two-dimensionality of the boundary layer is utilized in the present study. Direct measurements of Stanton numbers are available from which enthalpy thickness distributions can be calculated by integrating the two-dimensional energy equation.* These calculated values can be compared with those obtained using centerline velocity and temperature profiles at selective stations. The discrepancy between the two estimates is indicative of the degree of two-dimensionality.

For the most part, the calculated and measured enthalpy thicknesses agree within the experimental uncertainty of the data which is approximately ±8 percent for all unblown and blown flows and which reach a maximum of ±20 percent with strong suction (F = -0.002). Larger deviations are found to exist in some of the test runs for those profiles taken in the constant free-stream velocity approach region, but not in the pressure gradient region which is of major interest. This

*The reader is referred to reference [33] where all corresponding thermal data is reported and discussed.

suggests that if weak three-dimensional flows exist in the present data they are acceptable in view of the experimental uncertainty of these data.

For very low momentum and enthalpy thickness Reynolds number flows, small transverse variations in enthalpy thickness within the boundary layer, which are acceptable for thicker layers, become significant in this method of determining the degree of two-dimensionality. For this reason, it was found necessary to modify the apparatus for the test runs where $K = 1.45 \times 10^{-6}$ in order to obtain the indicated agreement among estimates of enthalpy thickness. The installation of a double screen upstream of the nozzle and the addition of a trip inside the nozzle minimized the transverse variations which existed.* For an indication of the detailed characteristics of these variations, the reader is referred to reference [17] where transverse velocity and temperature profile data taken prior to this modification are presented.

The discrepancies in the estimates of enthalpy thickness are given in Appendix A for each velocity profile where sufficient thermal data was available. With a few minor exceptions, this covers the velocity profile data corresponding to blowing and sucking fractions from F = -0.002 to 0.006.

E.5. Surface conditions

To satisfy the requirements of the ideal model, the porous surface must be aerodynamically smooth. In addition, the pore opening and pore spacing must be small such that the V_w inertia forces are small compared to the viscous forces at the surface.

Simpson [17] demonstrates, by means of appropriate models, that the latter of these two requirements is satisfied on the present apparatus. He further assumed that the plate "surface"

*A description of the screen and trip arrangements is given in Section B.1 of this chapter.

is in the plane of the particle crests for purposes of locating the "effective" no slip condition. The same location of the plate "surface" was assumed in the traverses of the present experimental study.

Restricting attention to flows over an impermeable flat plate allows an estimate of the test surface roughness and its influence on the present velocity profile data. According to the data of Nikuradse [36], if the surface particles are within the "viscous sublayer" ($\frac{U_\tau k_w}{12\nu} \leq 5$ where k_w = particle size) the surface is aerodynamically smooth. Utilizing this criterion and the measured RMS roughness value of 0.0002 [illegible] for k_w, it follows, that for U_∞ = 100 ft/sec and $C_f/2$ = 0.00300, $\frac{U_\tau k_w}{12\nu} \approx 0.6$ and the surface is smooth.

The impermeable flat plate data taken at different free-stream velocities yields a check on this preliminary analysis. In Figures 6, 7, and 8, it is shown that for free-stream velocities of 42 and 86 ft/sec, U^+ vs y^+ relationships are the same in the logarithmic region. If roughness was important, it is expected that this U^+ vs y^+ relationship would change with U_∞. In Figure 9, the profiles for U_∞ = 126 ft/sec are shown to be below the accepted "law of the wall" corresponding to smooth wall data. This is thought to be the result of experimental uncertainties in $C_f/2$ and possible surface roughness.

It is evident from previous experiments [19-23] that acceleration has the effect of increasing the "viscous sublayer" thickness of boundary layers on impermeable surfaces. Therefore, it is reasonable to conclude, on the basis of these results, that the test surface is aerodynamically smooth for all unblown experiments on this apparatus with and without acceleration where the level of U_∞ is less than 100 ft/sec. With the exception of the impermeable flat plate run for

U_∞ = 126 ft/sec, the level of U_∞ is within this bound in all the present data.

Simpson presents an argument concerning roughness effects with blowing and suction. Although the "viscous sublayer" is shown to decrease with blowing and increase with suction, the corresponding values of $\frac{U_\tau k_w}{12\nu}$ for his strongest blowing and suction data are found to be small. For the highest suction case examined ($C_f/2 = 0.0076$), it was found that $\frac{U_\tau k_w}{12\nu} \approx 0.5$ using $k_w = 0.0002$ inch. For the highest blowing case examined, $C_f/2 \approx 0.0001$ and $\frac{U_\tau k_w}{12\nu} \approx 0.05$. These estimates, presented by Simpson, are based on U_∞ = 44 ft/sec, whereas the levels of U_∞ found in the present experiments can be double this value. Taking this fact into account, the corresponding estimates of $\frac{U_\tau k_w}{12\nu}$ are still small enough to suggest that the test surface is aerodynamically smooth with blowing and suction. Sufficient proof of negligible roughness requires a direct basis of comparison which is not presently available in the cases of blowing and suction, and, therefore, this can only be taken as a plausibility argument as previously indicated by Simpson.

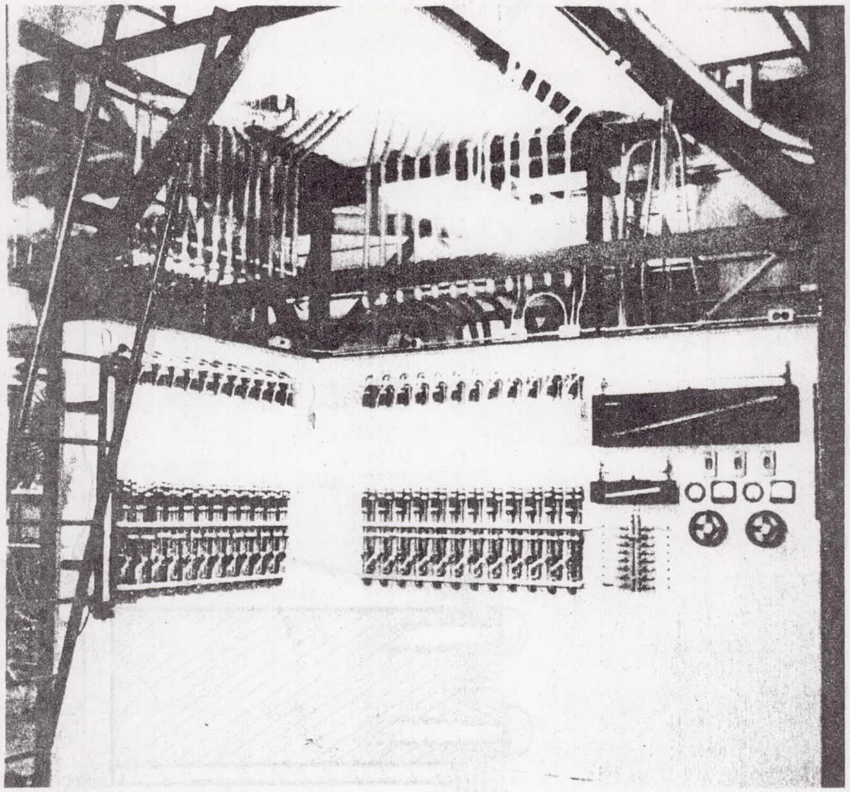


Figure 1. Photograph of operating console area

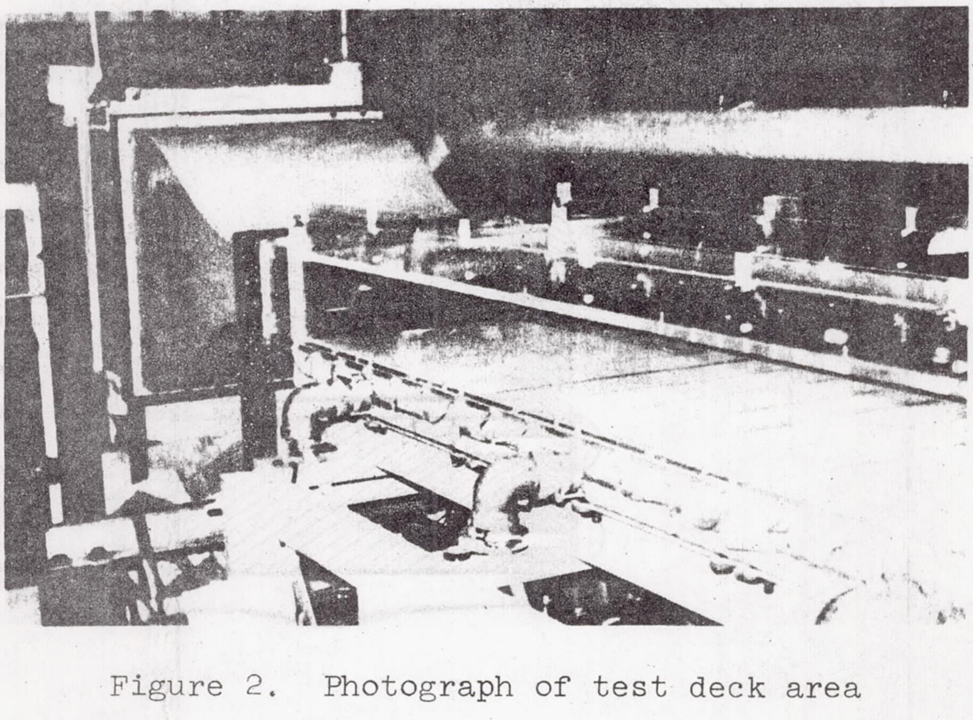


Figure 2. Photograph of test deck area

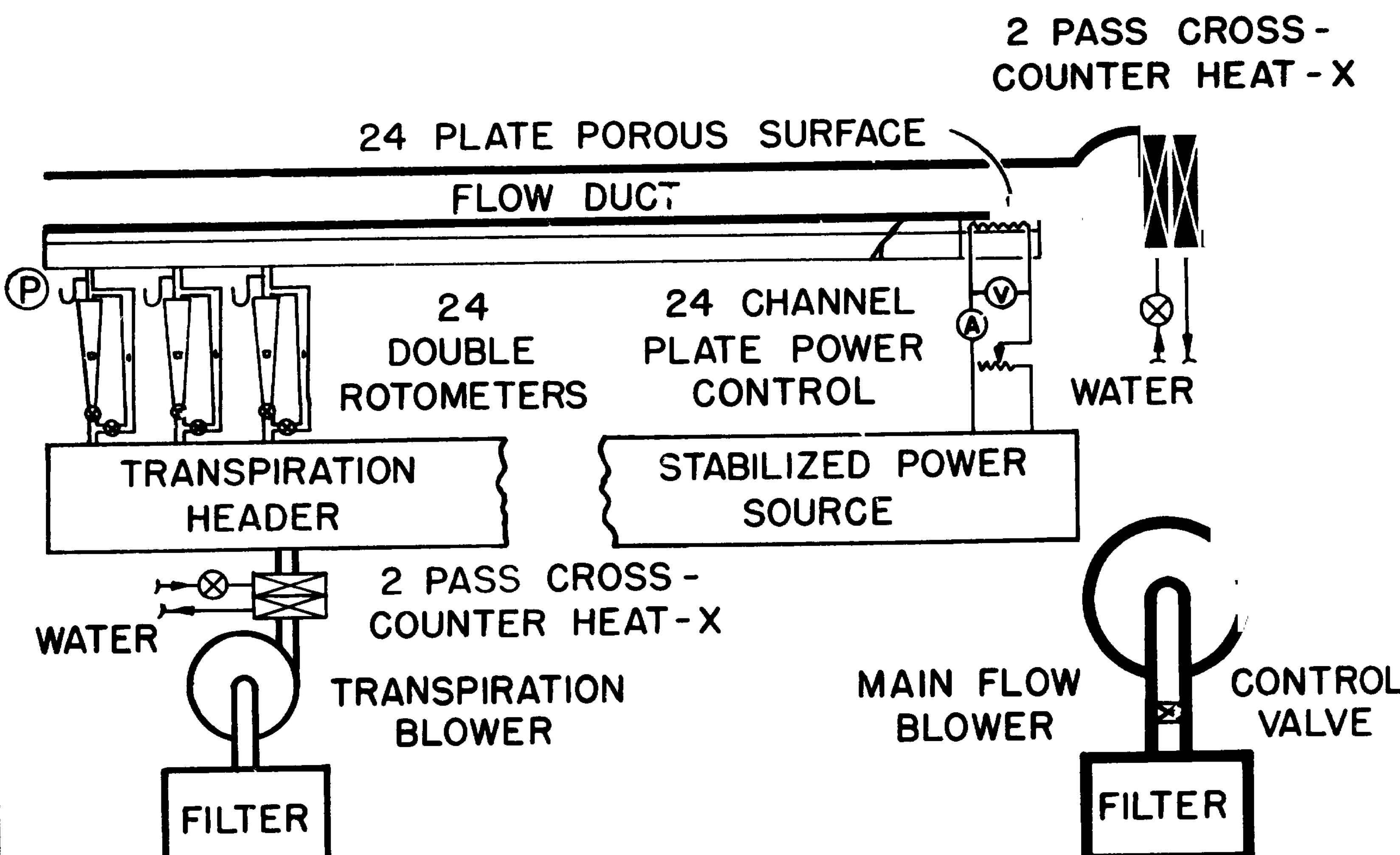
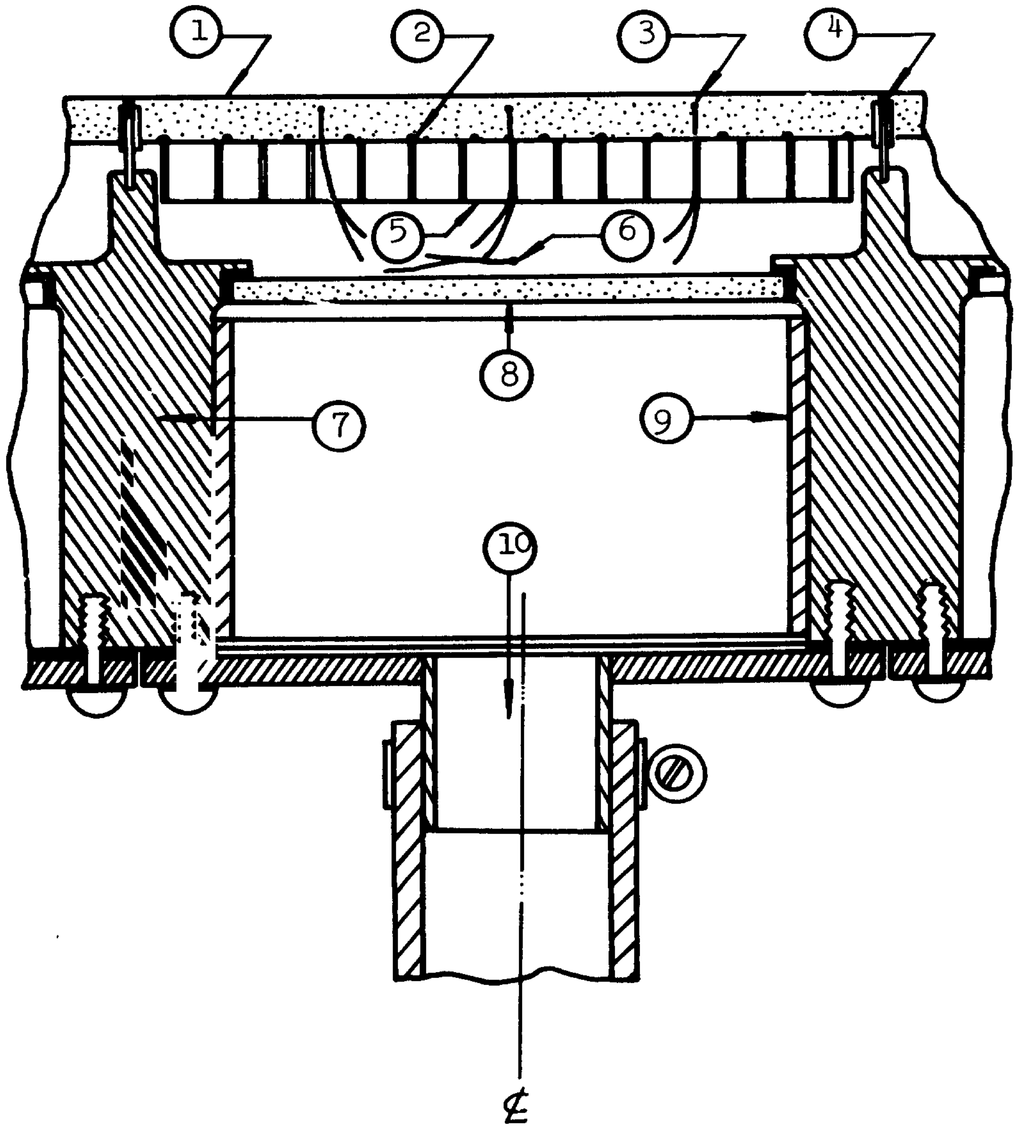


Figure 3. Test apparatus schematic



1. Porous plate
2. Heater wires
3. Thermocouples
4. Support webs
5. Honeycomb
6. Thermocouple
7. Base casting
8. Pre-plate
9. Balsa insulation
10. Delivery tube

Figure 4. Cross-section view of a typical compartment

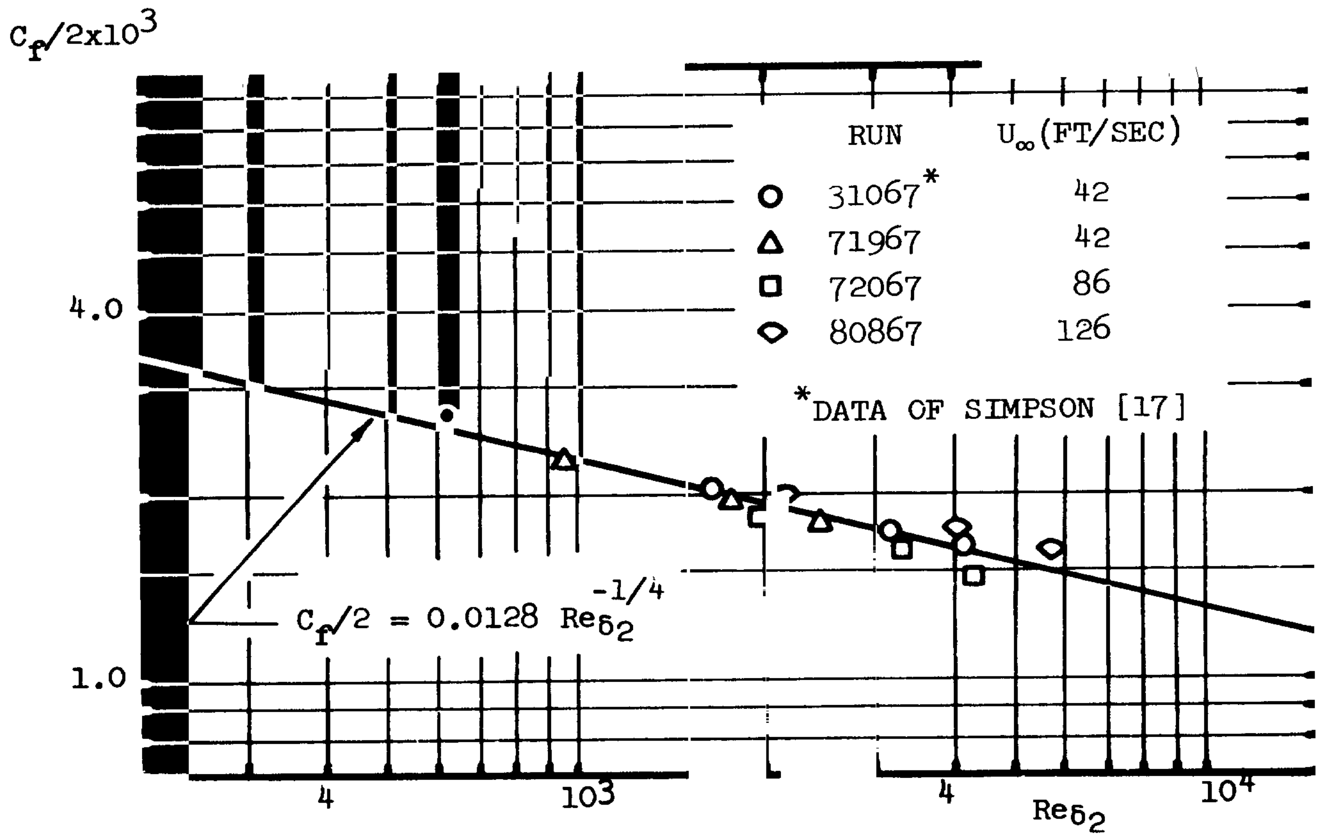


Figure 5. $C_f/2$ vs Re_{δ_2} , unblown flat plate

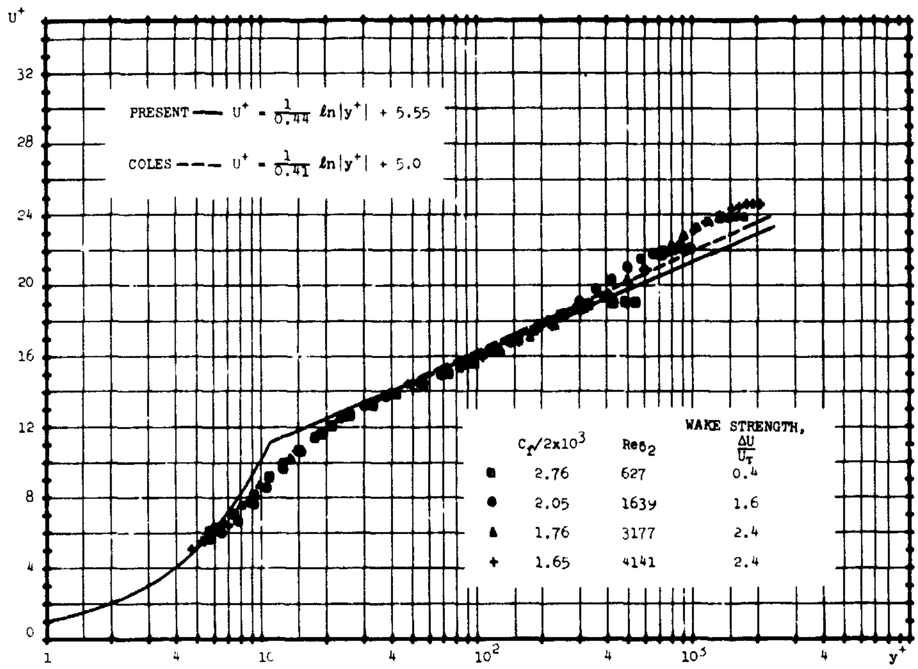


Figure 6.

Unblown flat plate data of Simpson: run 31067, U_∞ = 42 ft/sec

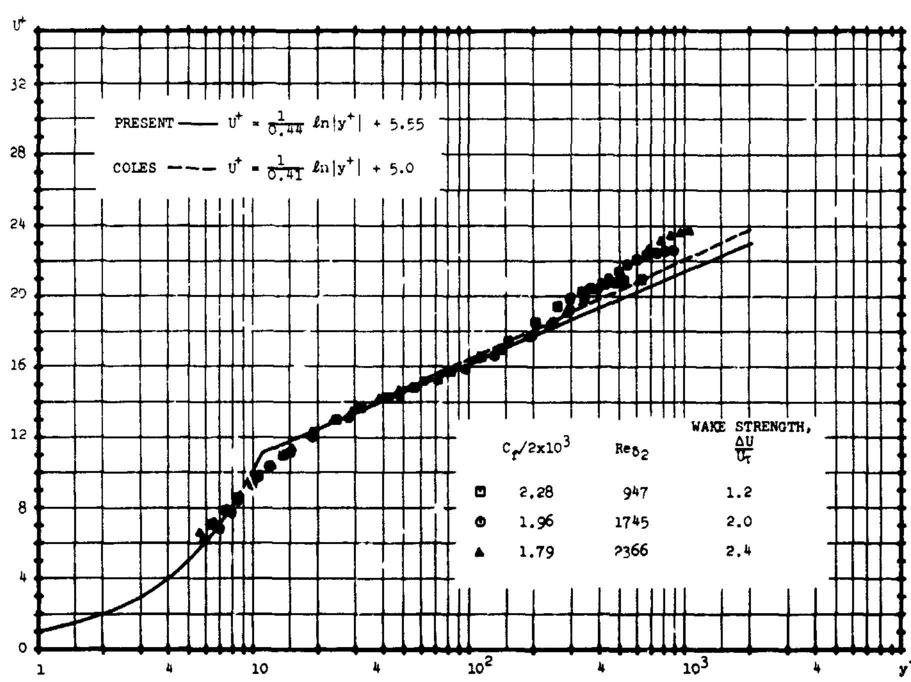


Figure 7.

Unblown flat plate: run 71967, U_∞ = 42 ft/sec

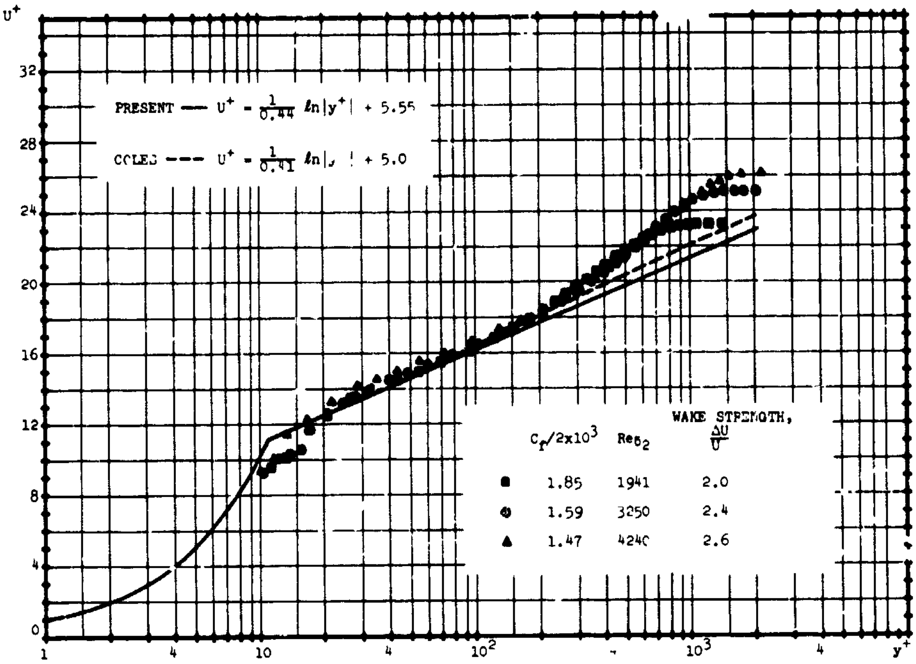


Figure 8.

Unblown flat plate: run 72067, U_∞ = 86 ft/sec

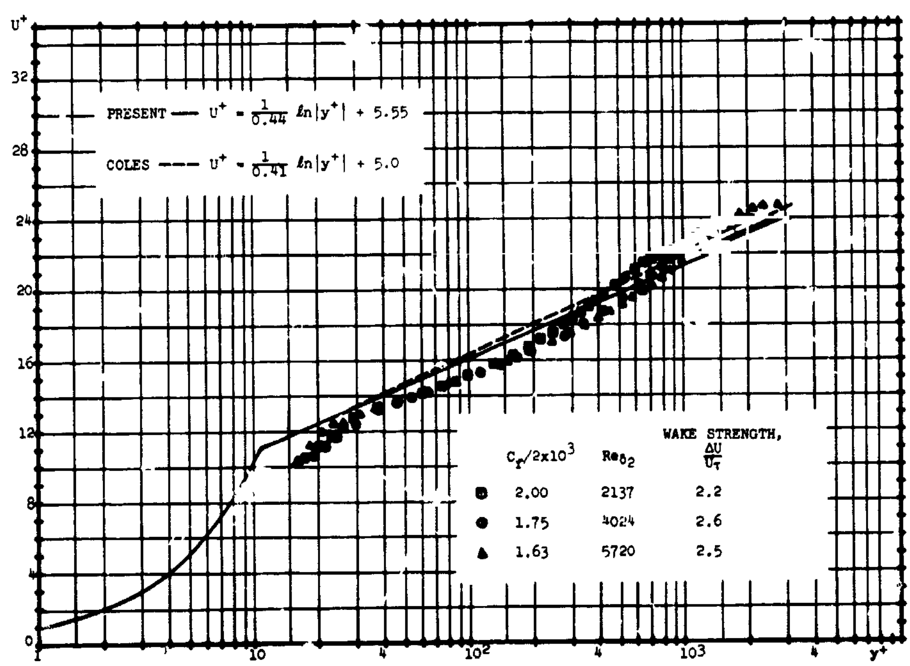


Figure 9.

Unblown flat plate: run 80867, U_∞ = 126 ft/sec

CHAPTER III

EXPERIMENTAL TECHNIQUES AND DATA REDUCTION METHODS

A. Experimental Techniques

The methods utilized to set up the desired flow conditions and the data taking procedures followed are described in this chapter.

A.1. Setting of upper wall and transpiration rates

The upper wall, the inlet velocity to the test section, and the transpiration rates must be carefully related to achieve an asymptotic boundary layer flow; i.e., one in which Re_{δ_2} is constant in the flow direction. Ideally, the pressure gradient should be imposed at a position where the boundary layer already has the asymptotic value of Re_{δ_2}. The mass flux at the wall must then be adjusted to maintain a constant blowing or sucking fraction F in the flow direction. These requirements were satisfied within reasonable accuracy in the present experiments.

The position where the pressure gradient should be imposed was determined using available correlations for boundary layer flows in constant free-stream velocity. Simpson [17] has shown that, for unaccelerated flows where the mass flux at the wall is constant,

$$\frac{C_f}{2} = c\, Re_{\delta_2}{}^{d} \qquad \text{(III-1)}$$

and

$$H = \frac{1}{1 - 3.1\sqrt{\frac{C_f}{2}}\left[(1 + B)^{1/2} + (1 + 0.635B)^{1/2}\right]} \qquad \text{(III-2)}$$

where c and d are unique functions of F . Applying these correlations to the asymptotic momentum integral equation yields an equation which can be solved for the value of Re_{δ_2} associated with given values of K and F ,

$$cRe_{\delta_2}^{d} = Re_{\delta_2}(H + 1)K - F . \qquad \text{(III-3)}$$

Inasmuch as the boundary layer is allowed to develop with constant free-stream velocity in the initial portion of the test section, this yields an estimate of the position where the desired value of Re_{δ_2} will be attained.

With the imposition of a strong pressure gradient the boundary layer is expected to adjust, resulting in different characteristics than those represented by the correlations utilized here. This, plus the fact that an abrupt acceleration is not possible, indicates that the above estimate is only approximate. For a given inlet free-stream velocity the predicted position at which the flow is to be accelerated is quite insensitive to F , assuming that the "virtual origin" does not change for the unaccelerated portion of the boundary layer. Hence, acceleration was begun at the same position in the test section for all blowing and sucking fractions.

As for the upper wall setting in the pressure gradient region, a one-dimensional flow analysis indicates that an inclined flat upper wall, to a good approximation, yields a constant K flow for a given blowing or sucking fraction. Neglecting boundary layer displacement and streamline curvature, conservation of mass requires that the equation of the upper wall surface be given by

$$\frac{y(X)}{y(X_a)} = 2 + \Omega\left[\frac{F}{K}\left(\frac{\nu}{yU_\infty}\right) \ell n\ \Omega - 1\right], \qquad \text{(III-4)}$$

where

$$\Omega = 1 + \frac{KU_\infty(X_a)}{\nu}[X-X_a] \qquad \text{(III-5)}$$

Here, X_a is the position where the pressure gradient is imposed. For all blowing and sucking fractions of concern this can be approximated by a linear variation within one percent. Based upon these considerations, an inclined flat upper wall was used to give a constant K flow.

The specific top settings used are shown schematically in Figure 10. The inlet velocity to the test section and the slope of the upper wall in the pressure gradient region were chosen to maximize the length of the pressure gradient region and yet retain a turbulent boundary layer at the duct inlet.

The transpiration rates needed to achieve a constant F for each test run were determined by means of an iterative process. The upper wall was first set for the desired combination of K and blowing or sucking fraction F. Transpiration flow rates were then set up, based upon the free-stream velocity distribution of a zero transpiration test run. The transpiration flow rates were adjusted based on the resulting distribution of free-stream velocity. The process was continued until the desired blowing fraction had been attained within the desired limits.

A.2. General test procedure

A specific test procedure was followed during each test run. After the air system had stabilized, the flowmeters were given final adjustments and the thermal data were taken. The traversing instruments were then positioned using spacers and a reference mark on the traversing support beam. Free-stream pitot readings for each boundary layer probe and a Kiel probe, all placed in the constant free-stream

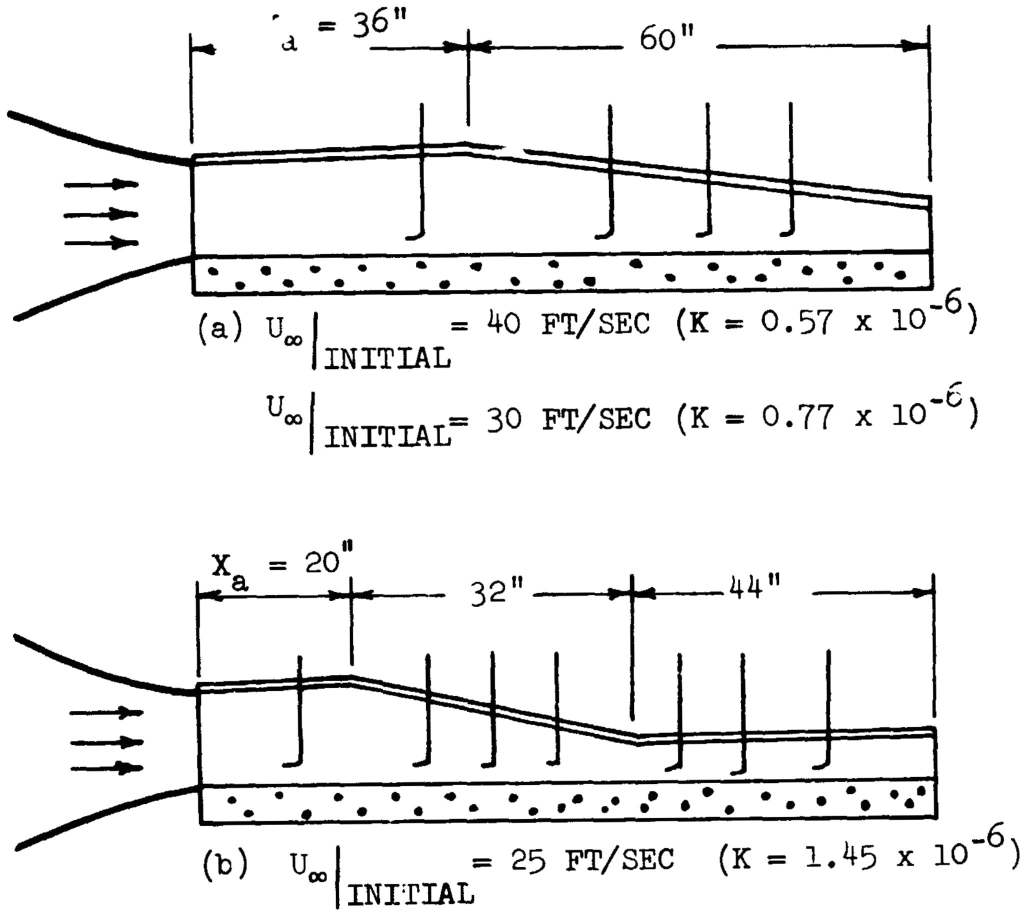


Figure 10.

Duct configurations for pressure gradient runs

velocity region of the channel, were compared to check for line leaks and possible fouling of the mouth of the boundary layer probes. After these initial adjustments and checks were made, velocity traverses were taken according to the procedure described below. When approximately half of the traverses were obtained, the static pressure distribution along the channel was measured and recorded along with the flowmeter settings and thermal data. All test conditions were monitored at intervals throughout the entire test run.

A.3. Traversing procedure

Velocity traverses were taken on the duct centerline in a manner similar to that used by Simpson [17]. The boundary layer probe was advanced toward the wall until contact between the mouth of the probe and the wall was visually evident. The probe was then backed away from the wall in 0.001 inch increments according to the micrometer scale. More than one reading was obtained with the probe on the wall during this procedure. The position where the probe left the wall was determined by means of a dynamic pressure method. This method is based on the fact that the indicated dynamic pressure remains the same as long as the probe touches the wall but increases markedly as it leaves. According to Simpson, this method of wall location agrees with an electrical contact method within 0.0005 inches. The probe was then advanced through the boundary layer in approximately equal intervals of dynamic pressure.

All dynamic pressure readings were obtained with the instrumentation described in Chapter II. The side static pressure ports were used as references in regions of the duct where the static pressure exceeded the 1-inch of water limit of the Dwyer manometers. The local static pressure necessary for the calculation of velocities was determined by linearly interpolating between static pressure ports adjacent to the mouth of the probe. The use of side ports

as references has the advantage of reducing the effects of minor time-variant fluctuations due to blower and ambient changes. The response of the probe-manometer system to within 0.001 inch of water of the approached value is estimated to be approximately 30 seconds but readings were taken over an additional one-minute interval to obtain a time average.

Prior to each traverse, manometers were zeroed and test conditions were monitored. These checks were also made at the completion of each traverse as a check on system changes during the data taking period.

B. Data Reduction

The raw experimental data was initially reduced by means of a computer program. A statement of the program in Fortran IV language is given in Appendix B. In its most general terms, the program performs the following functions:

1. Accepts input and converts to standard units.
2. Corrects for calibration curves of instrumentation.
3. Calculates velocity profile integral parameters using the trapezoidal rule.
4. Calculates dimensionless parameters.
5. Summarizes and prints out a raw data listing and a summary of output data with uncertainty intervals.*

In addition to the above, the output data were punched on computer cards which were utilized as input cards to secondary computer programs. The secondary programs were either correlation reduction programs or designed to produce plots and the final data tables, presented in Appendix A.

Specific features of the data reduction process are of considerable importance in the interpretation and correlation

*The uncertainty analysis is not presented in the program listing for purposes of clarity.

of results. For this reason, they are described in detail here. The method of reducing pitot tube readings and the associated uncertainty analysis are discussed. The method utilized to determine local blowing rates and pressure gradients is presented. The means utilized to obtain experimental estimates of friction factors are also presented in detail.

B.1. The reduction of pitot tube readings

The pitot tube data were reduced to values of mean velocity by application of the Bernoulli relation

$$U = \sqrt{\frac{2(P_s - P_o) g_c}{\rho}} \qquad \text{(III-6)}$$

after suitable corrections were applied. The corrections are applied to account for errors inherent to the flattened-mouth probes utilized.

Simpson [17] considered the importance of turbulent fluctuation, viscous, shear, yaw and pitch, and wall effects on pitot tubes of this type. He concluded that:

1. No correction for yaw or pitch angle need be applied for all the blowing and sucking cases he studied. He found that the mean streamline angles, $\tan^{-1}(V_w/U)$, were less than 10 degrees which is within the pitch plateau experimentally determined for these probes. Yaw angle corrections could be avoided by positioning the probe accurately.

2. The viscous correction that should be applied is based upon the data of Hurd, Chesky and Shapiro [34]. Letting

$$C_p = \frac{2(P_s - P_o) g_c}{\rho U^2} \qquad \text{(III-7)}$$

the correction he proposed is given by

$$C_p = 1.02 - \frac{0.566}{\sqrt{Re_p}} + \frac{3.53}{Re_p} \qquad \text{(III-8)}$$

for $Re_p < 40$ and $C_p = 1.0$ for $Re_p \geq 40$.
The Reynolds number Re_p is based on the outside hydraulic diameter of the probe mouth and the local velocity.

3. The turbulent fluctuation components of velocity can be neglected, resulting in only slight errors in the uncorrected velocity profile.

4. Negligible shear gradient and wall effects were found in the severe case of an asymptotic suction layer. Therefore, these effects were not considered in the remaining cases he studied.

The same set of corrections is used in the present study. The mean streamline angles are found to be within the bounds stated by Simpson and, hence, yaw and pitch angle corrections are not applied. Since turbulent fluctuation components were not measured, a turbulent fluctuation correction cannot be applied. Shear gradient and wall effects are neglected inasmuch as the cases studied here are not as severe as the asymptotic suction layer flow studied by Simpson.

B.2. Determination of local blowing rates and pressure gradients

As indicated in Chapter II, the mass flux through each plate can be considered uniform within the limits of the plate porosity variation. The effects of the static pressure drops encountered in the mainstream flow direction for those cases considered here were found to be negligible. Hence,

the mass flux at a given velocity traverse station is taken to be that corresponding to the center 6-inch span of the associated plate. The blowing fraction F, in turn, is based upon this mass flux and the local free-stream velocity for each traverse. The same approach is taken for the suction cases.

The fact that constant K flows are being studied is utilized to determine local values of the applied pressure gradient. The pressure gradient at each static port is taken to be that corresponding to a linear velocity distribution between the adjacent static ports. Selected values of the resulting pressure gradients are found to agree with values obtained from a plot of the free-stream velocity distributions, within ± 5 percent. The free-stream velocities at each static port station are determined from the free-stream velocity head, measured in the constant free-stream velocity approach region of the duct, and the measured static pressure distribution. These measurements are sufficient for this purpose only if the total pressure head remains constant and, hence, a potential core was maintained during each test run. These known quantities at the static port stations allow local pressure gradients to be determined by linear interpolation of the parameter K between adjacent static ports.

B.3. Experimental determination of friction factor

The friction factor $C_f/2$ is experimentally determined by four different methods. These methods are of the indirect type and all four are not applied to the same profile. Each of these methods is described, with assumptions stated and an indication of where each is applied in the present study. Due to the propagation of experimental errors in the use of these methods, it is found necessary to obtain a "best estimate" of friction factor. The approach taken to obtain this estimate is also described.

B.3.a Momentum integral methods

Two methods of obtaining friction factors from the two-dimensional, constant property momentum integral equation are utilized. One method is applicable in boundary layer flows where the free-stream velocity is maintained constant, whereas the other is only applicable in near-asymptotic boundary layer flows of the type considered in the present study.

i. Constant free-stream velocity

Restricting attention to two-dimensional boundary layer flows over impermeable flat plates, the constant property momentum integral equation can be expressed

$$\frac{C_f}{2} = \frac{dRe_{\delta_2}}{dRe_x} \qquad \text{(III-9)}$$

With measured values of momentum thickness at successive X-stations, this relation can be used to obtain values of $C_f/2$ for such flows. In order to reduce the error inherent in the evaluation of the derivative involved, the following power fit is assumed to apply.

$$Re_{\delta_2} = aRe_x^b \qquad \text{(III-10)}$$

For Re_x measured from the "virtual origin", this is considered representative of the actual flow condition. Substitution of this relation into the above momentum integral equation yields the following expression for the friction factor $C_f/2$,

$$\frac{C_f}{2} = abRe_x^{b-1} \qquad \text{(III-11)}$$

Hence, estimates of $C_f/2$ are obtained from an experimental determination of the constants a and b . A similar approach can be taken in cases where either blowing or sucking at the wall exists. The reader is referred to reference [17] for a discussion of this more general approach.

This particular method requires more than one velocity traverse as well as a determination of a "virtual origin". For this reason, it was only utilized for the surface roughness investigation discussed in Chapter II where both requirements were satisfied.

ii. Near-asymptotic flow

As indicated in Chapter I, the constant property two-dimensional momentum integral equation can be expressed as

$$\frac{C_f}{2} = Re_{\delta_2}(H + 1)K - F + \frac{dRe_{\delta_2}}{dR_x} . \qquad \text{(III-12)}$$

For near-asymptotic flows such as those considered in the present study,

$$\frac{dRe_{\delta_2}}{dR_x} << Re_{\delta_2}(H + 1)K - F \qquad \text{(III-13)}$$

This characteristic allows equation (III-12) to be used to calculate friction factors in this type of flow on the basis of local experimental data with a small correction term, $\frac{dRe_{\delta_2}}{dR_x}$, applied. The relative magnitude of the correction term does increase with an increase in blowing fraction. This is the result of the right side of equation (III-13) tending toward zero with an increase in blowing fraction. Similar

undesirable effects are present in all momentum integral approaches when blowing is considered.

The following procedure is followed in the evaluation of the correction term $\frac{dRe_{\delta_2}}{dR_x}$. In terms of the local X-Reynolds number, this term may be expressed

$$\frac{dRe_{\delta_2}}{dR_x} = \frac{dRe_{\delta_2}}{dRe_x}(K\ Re_x + 1) \qquad \text{(III-14)}$$

This relation is used with an assumed fit to the experimental data given by

$$Re_{\delta_2} = m \exp[n\ Re_x] \qquad \text{(III-15)}$$

where the experimentally determined constants m and n are based on successive velocity profiles taken in the pressure gradient region of the duct. If possible, the profile downstream of the X-station of interest was used for this purpose. The term was evaluated on the basis of the local X-Reynolds number rather than the integrated X-Reynolds number to avoid a propagation of uncertainties in the pressure gradient parameter K . Equation (III-15) is found to fit the trend of the experimental data.

Equation (III-12) was used to obtain values of $C_f/2$ for all profiles measured in the pressure gradient region of the duct. For purposes of confirmation and slight adjustments, the viscous sublayer model method described in the following section was used as an independent means of obtaining values of $C_f/2$.

B.3.b <u>Viscous sublayer model method</u>

This method relies on the fact that in a thin region near the wall molecular viscosity governs the

flow. Neglecting X-derivatives and treating the flow as laminar in this region, the constant property boundary layer equations yield the solutions

$$\frac{U}{U_\infty} = \frac{1}{F}\left\{\left(\frac{C_f}{2} - \frac{K}{F}\right)\left[\exp\left(\frac{V_w y}{\nu}\right) - 1\right] - K\left(\frac{yU_\infty}{\nu}\right)\right\}$$

$$\text{for } F \neq 0.0 \qquad \text{(III-16)}$$

and

$$\frac{U}{U_\infty} = \left(\frac{yU_\infty}{\nu}\right)\left\{\frac{C_f}{2} - \frac{K}{2}\left(\frac{yU_\infty}{\nu}\right)\right\}$$

$$\text{for } F = 0.0\ . \qquad \text{(III-17)}$$

These relations can be solved for $C_f/2$, allowing the calculation of friction factors from experimental values of V_w, U, U_∞, and y. Here, U must correspond to a y-position within the region of application of these solutions.

The reliability of this method is dependent upon the ability to measure low dynamic pressures within the "viscous sublayer" and the accuracy within which the probe position relative to the wall is known. Hence, it was used to confirm friction factors obtained by means of the momentum integral equation. Friction factors corresponding to profiles traversed at stations in the entrance and recovery sections of the duct were also estimated by this method.

B.3.c Logarithmic region method

This method of determining friction factors is based on the assumption that a "universal law of the wall" exists. The specific form of this law proposed by Simpson [17] for the impermeable wall case is given by

$$U^+ = \frac{1}{0.44} \ln|y^+| + 5.55 \qquad \text{(III-18)}$$

This relation is assumed to apply to those regions of the duct where free-stream velocity is maintained constant for all unblown test runs. Velocity profile data can be cross-plotted against this assumed relation to yield an estimate of the associated friction factor.

Various "laws of the wall" for turbulent boundary layers have been proposed [15,17,29] which account for the effect of blowing and applied pressure gradients. Since these are in disagreement with one another and are not based on data for the combined problem, they are not considered in the present evaluation of friction factors.

B.3.d Determination of best estimate of friction factor

The "best estimates" of friction factor were obtained by blending the experimental velocity profiles with the viscous sublayer equation.

The graphical procedure used in the pressure gradient region was based on the following observations:

1. The viscous sublayer equation was not sensitive to small changes in the friction factor so that the momentum integral values could be used to predict sublayer profiles.

2. On the basis of the viscous sublayer equation and the U^+ vs y^+ profiles corresponding to the momentum integral values of $C_f/2$, the inner regions of the sublayer ($y^+ < 15$) appeared invariant in the streamwise direction for the majority of the data.

For a given test run, all profiles in the pressure gradient region were inspected simultaneously. The profile which best matched the viscous sublayer equation was selected as a

reference profile. A slight adjustment in the value of $C_f/2$ for the reference profile was made for some of the test runs if agreement with the viscous sublayer equation was not obtained to the degree found in the majority of the data. The remaining profiles were then matched to the viscous sublayer equation with the requirement that the velocity distributions in the inner regions ($y^+ < 15$) correspond to that for the reference profile.

In this procedure, a first estimate of friction factor was obtained by the momentum integral method. The resulting "best estimates" of $C_f/2$ were found to agree with the momentum integral values within the uncertainty of the correction term $\frac{dRe_{\delta_2}}{dRe_x}(Re_x K)$ applied in the momentum integral method. The calculated uncertainties in the correction term represent variations in friction factor of approximately ± 0.00020 , ± 0.00030 and ± 0.00040 in the present data for $K = 0.57 \times 10^{-6}$, 0.77×10^{-6} and 1.45×10^{-6} , respectively. This amounts to approximately 15 percent of friction factor for the unblown runs and to as much as 50 percent for the highly blown runs.

For the unblown test runs, the logarithmic region method values of friction factor were considered "best estimates" for all constant free-stream velocity profiles.

For the blowing or suction cases, "best estimates" of friction factor were found for all constant free-stream velocity profiles by graphically matching the U^+ vs y^+ profiles to the viscous sublayer equation. If data points were not found to exist in the viscous sublayer region an extrapolation of the existing data points was used. This extrapolation was based on experimental profiles of Simpson [17] corresponding to approximately the same values of Re_{δ_2} and F . In this graphical matching procedure as many data

points as possible were used and not just two data points near the wall as was done in the viscous sublayer method.

The deviations of the other experimental determinations from these "best estimates" are discussed in Chapter IV with other experimental results.

B.4. Uncertainty intervals

Only those uncertainties resulting from the necessary interpolation between divisions on an instrument and those due to fluctuating values of the measurand are considered in the present uncertainty analysis. Errors in instrumentation calibration are not considered since they are "fixed errors" and uncertainties due to uncontrolled peripheral variables of the experiment cannot adequately be estimated.

The procedure of Kline and McClintock [37] is followed to account for the propagation of uncertainties in all calculated quantities. The following basic uncertainty intervals are assumed with 20:1 odds:

Distance from the wall	0.0005 inches
Flowmeter reading (25 cm full scale)	0.02 centimeters
Dynamic pressure	0.002 inches of water
Relative locations of static ports	0.008 inches
Location of probe relative to static ports	0.016 inches

The resulting estimates of uncertainties in the calculated quantities are indicated in the data tabulations found in Appendix A.

C. Calculation of Shear Stress Profiles

Shear stress profiles were generated from the measured mean velocity profiles in order to check commonly assumed shear stress distributions in the inner regions of the boundary layer. The relation used for this purpose is developed here.

The following assumptions are made:

(1) U/U_∞ vs y/δ similarity holds for the entire boundary layer, i.e., X dependency contained in δ, where δ/δ_2 = constant.

(2) The contribution due to the non-asymptotic condition $\frac{dRe_{\delta_2}}{dR_x} \neq 0$ is small in the inner regions.

The importance and applicability of these assumptions is presented in the following development and discussion.

For constant property two-dimensional boundary layers, the X-momentum and continuity equations can be expressed in the integral forms

$$\frac{1}{\rho}\left[\tau - \tau_w - y\left(\frac{dP}{dx}\right)\right] = \frac{d}{dx}\int_0^y U^2 dy + UV \tag{III-19}$$

and

$$V = V_w - \frac{d}{dx}\int_0^y U\, dy\ , \tag{III-20}$$

respectively. Substituting equation (III-20) into equation (III-19) yields

$$\frac{1}{\rho}\left[\tau-\tau_w-y\left(\frac{dP}{dx}\right)\right] - UV_w = \frac{d}{dx}\int_o^y U^2 dy - U\frac{d}{dx}\int_o^y U\,dy$$

(III-21)

By means of simple operations of calculus and appropriate definitions, the following identities are obtained.

$$\frac{d}{dx}\int_o^y U^2\,dy = \delta U_\infty^{\,2}\,\frac{d}{dx}\int_o^{y/\delta}\left(\frac{U}{U_\infty}\right)^2 d(y/\delta) +$$

$$+\left[\frac{U_\infty^{\,2}}{\delta}\,\frac{d\delta}{dx} + 2\,U_\infty\,\frac{dU_\infty}{dx}\right]\int_o^y\left(\frac{U}{U_\infty}\right)^2 dy \qquad \text{(III-22)}$$

and

$$\frac{d}{dx}\int_o^y U\,dy = \delta\,U_\infty\,\frac{d}{dx}\int_o^{y/\delta}\left(\frac{U}{U_\infty}\right) d(y/\delta) +$$

$$+\left[\frac{U_\infty}{\delta}\,\frac{d\delta}{dx} + \frac{dU_\infty}{dx}\right]\int_o^y\left(\frac{U}{U_\infty}\right) dy \qquad \text{(III-23)}$$

Substituting these identities into the right-hand side of equation (III-21) and applying the similarity assumption (1) gives

$$\frac{1}{\rho}\left[\tau - \tau_w - y\left(\frac{dP}{dx}\right)\right] - U\,V_w = U_\infty \frac{dU_\infty}{dx} \int_o^y \left(\frac{U}{U_\infty}\right)^2 dy \;+$$

$$+\left[\frac{U_\infty^{\;2}}{\delta}\frac{d\delta}{dx} + U_\infty \frac{dU_\infty}{dx}\right] \int_o^y \left(\frac{U}{U_\infty}\right)^2 dy - \left(\frac{U}{U_\infty}\right) \int_o^y \left(\frac{U}{U_\infty}\right) dy$$

(III-24)

For δ/δ_2 = constant , a result of assumption (1), it can be shown that

$$\frac{U_\infty^{\;2}}{\delta}\frac{d\delta}{dx} = \frac{U_\infty^{\;2}}{\delta_2}\frac{dRe\delta_2}{dR_x} - U_\infty \frac{dU_\infty}{dx} \;. \qquad \text{(III-25)}$$

Substitution of equation (III-25) into equation (III-24) yields

$$\frac{1}{\rho}\left[\tau - \tau_w - y\left(\frac{dP}{dx}\right)\right] - U\,V_w = U_\infty \frac{dU_\infty}{dx} \int_o^y \left(\frac{U}{U_\infty}\right)^2 dy \;+$$

$$+\;\frac{U_\infty^{\;2}}{\delta_2}\frac{dRe\delta_2}{dR_x}\left[\int_o^y \left(\frac{U}{U_\infty}\right)^2 dy - \left(\frac{U}{U_\infty}\right) \int_o^y \left(\frac{U}{U_\infty}\right) dy\right].$$

(III-26)

Dividing both sides of equation (III-26) by τ_w , transposing terms, and applying the definitions of τ^+ , U^+ , y^+ , $V_w^{\;+}$, p^+ , and C_f , the following expression is obtained.

$$\tau^+ = 1 + U^+V_w^{\ +} + y^+p^+\left[1 - \frac{1}{y}\int_o^y \left(\frac{U}{U_\infty}\right)^2 dy\right] \quad +$$

$$+ \quad \frac{1}{\delta_2\left(\frac{C_f}{2}\right)}\,\frac{dRe_{\delta_2}}{dR_x}\left[\int_o^y \left(\frac{U}{U_\infty}\right)^2 dy - \left(\frac{U}{U_\infty}\right)\int_o^y \left(\frac{U}{U_\infty}\right) dy\right]$$

(III-27)

This was used for calculating the distribution of shear stress. The integrals involved were evaluated using the trapezoidal rule and the derivative $\frac{dRe_{\delta_2}}{dR_x}$ was taken to be that used in the momentum integral method of estimating friction factor.

Shear stress profiles were computed for traverses in a region of the duct where profile similarity was found to exist in accordance witn assumption (1). Assumption (2) does not explicitly appear in this development but limited errors due to uncertainties involved in the evaluation of the derivative $\frac{dRe_{\delta_2}}{dR_x}$.

CHAPTER IV

THE EXPERIMENTAL RESULTS

The experimental data consist of mean velocity profiles obtained in near-asymptotic boundary layer flows where the pressure gradient parameter K and blowing fraction F are maintained constant. Three pressure gradients were investigated: $K = 0.57 \times 10^{-6}$, 0.77×10^{-6}, and 1.45×10^{-6}. For each pressure gradient, the conditions investigated cover a range of uniform blowing fractions from $F = -0.004$ to 0.006.

The estimates of friction factor and their consistency and reliability are discussed in this chapter. Mean velocity profiles are also presented and checked for profile similarity and development characteristics.

The asymptotic characteristics of these boundary layer flows are discussed. Shear stress distributions, computed for purposes of representing sublayer data, are also presented.

All data presented graphically are also tabulated in Appendix A with estimates of their uncertainties.

A. Friction Factor Data

Estimates of friction factors were obtained for each of the experimental velocity profiles. The methods utilized in obtaining these estimates are discussed fully in Chapter II and the friction factor data is presented and discussed here.

Restricting attention to profiles taken in the pressure gradient region of the duct, two experimental determinations of $C_f/2$ are available. In Appendix A, the values of $C_f/2$ given correspond to:

1. Near-asymptotic momentum integral method
2. Viscous sublayer model method (average of values corresponding to first two profile data points)
3. "Best estimates" of $C_f/2$ utilized in succeeding data reduction.

For 63 out of a total of 79 profiles, the momentum integral values of friction factor agree with the "best estimates" within ± 10 percent. For 61 profiles, the viscous sublayer values are also found to agree with the "best estimates" within ± 10 percent. In the majority of these profiles where agreement was not found with the viscous sublayer method, the "viscous sublayer" had not been adequately penetrated during the traversing procedure. Only 2 profiles are presented where the momentum integral value and viscous sublayer value do not agree with the "best estimate" within this ± 10 percent range.*

In the constant free-stream velocity approach and recovery regions of the duct, only the viscous sublayer method was used. One exception is the impermeable wall case where the logarithmic region method was used. Slightly less than half of the profiles in this region had agreement between the viscous sublayer values and "best estimates" of $C_f/2$ within ± 10 percent. This poor agreement is explained, for the most part, by the inability to penetrate the "viscous sublayer", a predominant characteristic in the recovery region of the duct.

Simpson [17] correlated friction factor data on the basis of the blowing parameter $B = \frac{F}{C_f/2}$ and the unblown friction factor correlation

$$\frac{C_{f_o}}{2} = 0.0130 \, Re_{\delta_2}^{-1/4} \quad . \qquad \text{(IV-1)}$$

He found that, for constant free-stream velocity and a variety of blowing and suction distributions, the friction factor data obtained on the present apparatus could be fitted

*These profiles are for run 81668, M = 4, and 5 .

by the relation

$$\left.\frac{C_f}{C_{f_0}}\right|_{Re_{\delta_2}} = \left[\frac{\ln|1+B|}{B}\right]^{0.7} \qquad \text{(IV-2)}$$

The friction factor data of Simpson, for constant and slowly varying $\dot{m}''$ cases, agreed with equation (IV-2) within his calculated experimental uncertainty. Simpson sets this uncertainty at approximately ± 10 percent for $B \leq 0$ and as much as $\pm$ 25 percent for the higher values of B encountered in the present study.

The "best estimates" of friction factors for the present pressure gradient data and constant free-stream velocity data are compared with equation (IV-2) in Figure 11. The constant free-stream velocity data are shown to be consistent with this correlation within the calculated uncertainty and no anomalous effects are noted. Friction factors for the pressure gradient data are shown to lie 10 to 20 percent above the values given by equation (IV-2) for all accelerations combined with blowing and below by approximately 10 to 25 percent for all accelerations in the case of suction.

It is concluded that the "best estimates" of friction factor for the present velocity profile data are self-consistent and are in acceptable agreement with the experimental determination according to either the momentum integral method or the viscous sublayer method. It is found that the present friction factor data for constant free-stream velocity agrees with that of Simpson. The effect of acceleration on $C_f/2$ is found to differ in the cases of blowing and suction. In either case this results in relatively small deviations from equation (IV-2).

B. Mean Velocity Profile Data

The characteristics of the mean velocity profile data are discussed here. Profile similarity in both the inner regions and outer regions of the boundary layer are considered. The development characteristics and asymptotic behavior of the boundary layer flows are also presented.

B.1. Inner region development and similarity

Velocity profiles are present in wall coordinates (U^+ vs y^+) in Figures 12 through 20 utilizing the "best estimates" of friction factor. For purposes of comparison, the accepted "law of the wall" with constants proposed by Simpson [17] is also presented on each of the graphs. The profile obtained in the constant free-stream velo^ity approach region is presented along with the profiles obtained in the pressure gradient region of the duct.

For the impermeable wall case, all three pressure gradient runs are presented. It is shown in Figures 12 through 14 that the inner region of the boundary layer respond rapidly to the imposed pressure gradient and assume a unique distribution corresponding to a given value of K. For the strongest pressure gradient, $K = 1.45 \times 10^{-6}$, slight adjustments of the layer are found to exist through the entire pressure gradient region. It is concluded that, in the impermeable wall case, similar inner region profiles exist in these near-asymptotic boundary layer flows, and that the shape of the profile is dependent upon the value of the local pressure gradient parameter K.

Two characteristics of these boundary layer flows are shown in these inner region coordinates: (1) The profiles deviate from the acceptea "law of the wall" in an "overshot" manner within the logarithmic region and (2) the wake region is substantially diminished. The indicated profile "overshoot" is specifically an upward displacement of the U^+ vs y^+

profile from the "flat plate law of the wall" in the fully turbulent region of the layer. Similar qualitative characteristics have been observed by Launder and Stinchombe [20], and Patel and Head [24]. Patel and Head reported an initial "undershoot" of the logarithmic region, not seen in the present data. In the present study, traverses were not taken at stations along the duct where initial adjustments of the layer to the imposed pressure gradient occurred. Hence, the indicated results do not exclude this possibility. For the present data, it is shown that the degree of "overshoot" in the logarithmic region increases with K . This behavior can be represented as an increase in the thickness of the "viscous sublayer" region. The diminished wake is a direct result of the low shear stress in the outer regions of the layer, a characteristic associated with favorable pressure gradients. The resulting effect of these structural changes is to produce an "overshoot" profile in the logarithmic region where the logarithmic region decreases in its extent with the parameter K . This behavior is in agreement with the continuous re-laminarization observed by Patel and Head in accelerated flows stronger than those in the present study.

The relative constancy of the friction factors for these unblown constant K flows is also indicated in Figures 12 through 14. In inner region coordinates the natural pressure gradient parameter is $p^+ = \frac{g_c \mu_w}{\rho_w^2 U_\tau^3} \frac{dP}{dx}$, according to a dimensionless momentum equation. For constant property flows, this parameter can be expressed as $p^+ = -K/(C_f/2)^{3/2}$. Hence, these constant K boundary layer flows are also characteristic of constant p^+ flows. The inner regions are, therefore, related on the basis of this parameter for use in the theoretical prediction of results. The theoretical predictions are presented in Chapter V.

In Figures 15 through 18, similar effects of acceleration are shown to exist with blowing at the wall. The adjustment of the layer in the inner regions is found to be greater from station to station with blowing. The degree of overshoot the profiles exhibit above the flat plate profile is found to be decreased with blowing. This behavior is possibly the result of the increased turbulence level in the boundary layer due to blowing. The wake region is also found to be decreased to a greater extent than in the unblown layer, indicating a greater increase in friction factor with acceleration.

These similar inner regions of the boundary layer are related on the basis of the natural parameters p^+ and $V_w^{\ +}$ in Chapter V.

The boundary layer flows in the case of suction at the wall are shown in Figures 19 and 20 to have similar characteristics as found in the unblown and blown layers. The profile "overshoot" is found to be greater as expected. For moderate suction the adjustment of the layer to one exhibiting similar inner regions is shown to exist except in the case of a very strong acceleration, where the structure of the inner region attains predominately laminar characteristics (roundness of profile). In all combined pressure gradient and suction runs, substantial structural changes of this type in the inner region were noted with the exception of those flows where $K = 0.55 \times 10^{-6}$, and $F = -0.001$ and -0.002.

It is concluded that the qualitative characteristics of boundary layer flows for acceleration apply for the range of blowing and sucking fractions considered in the present study. The quantitative effects are dependent on blowing or sucking fraction and similar-profiles in the inner regions are found to exist except in flows where the structure of the inner regions of the layer appears to be substantially and continually changing, which suggests that relaminarization is perhaps occurring.

B.2. Outer region development and similarity

The development of the outer regions of these asymptotic and near-asymptotic boundary layer flows is shown in Figures 20 through 26. Here U/U_∞ vs y/δ profiles are presented comparing the profile in the approach region with those obtained in the pressure gradient region of the duct.

It is demonstrated that, for all blowing and sucking fractions considered, the layers approach and attain an asymptotic limit, characterized by similar profiles in these coordinates. The flows where the sucking fraction was $F = -0.004$ are exceptions to this rule since the profiles are found to continually adjust to a laminar mode, a characteristic not indicated in the flows graphically represented. It is noteworthy that similarity in these coordinates also implies similarity in "velocity-defect" coordinates since friction factors in the flow direction are found to be essentially constant.*

In the impermeable wall case, this similarity behavior indicates that asymptotic boundary layer flows for the present range of K are also constant β flows where $\beta < -0.5$, as shown in Chapter I.

The response of the layer to its asymptotic condition is shown to be extended farther down the pressure gradient region of the duct with an increase in blowing fraction, which is reasonable in view of the greater adjustment found necessary with blowing. The suction run with the strong pressure gradient, $K = 1.45 \times 10^{-6}$, is shown in Figure 27 not to follow this trend, suggesting structural changes in the boundary layer as noted in the discussion of the inner regions.

It is concluded that in the asymptotic and near-asymptotic boundary layer flows investigated in the present study similar

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* "Velocity-defect" coordinates are $\frac{U_\infty - U}{U_\tau}$ vs y/δ .

profiles were attained in the outer regions of the layer, except in the flows where the sucking fraction was -0.004 . This coupled with a similar conclusion relating to the inner region of the layer confirms the existence of completely similar profiles in asymptotic boundary layer flows, with the exception of the suction cases noted in the discussion of the inner regions.

B.3. Asymptotic values of local momentum thickness Reynolds number and shape factor

By definition the asymptotic boundary layer flows considered in the present study are characterized by a constant value of Re_{δ_2} . The present experimental data indicates that unique values of Re_{δ_2} and shape factor H correspond to given values of the pressure gradient parameter K and blowing fraction F .

In Figure 28, the values of Re_{δ_2} , corresponding to the last two or three profiles obtained in the pressure gradient region of the duct are plotted against K , for parametric values of F . The agreement between the values of Re_{δ_2} associated with consecutive profiles for a given run shows the success in attaining an asymptotic condition for all three values of K where $F \geq -0.002$. The continuous trend of the data displayed in this figure indicates these asymptotic conditions are unique in view of the fact that the values of K correspond to different ranges of free-stream velocity in the present experiments.

In Figure 29, the experimental estimates of the asymptotic values of Re_{δ_2} for the impermeable wall flows are compared with those values corresponding to an assumed turbulent velocity profile and an exact laminar solution. The assumed turbulent velocity profile is given by the equation

$$U^+ = 8.7(y^+)^{1/7} \qquad \text{(IV-3)}$$

Applying this equation to the asymptotic form of the two-dimensional momentum integral equation yields the relation

$$Re_{\delta_2}\Big|_{asymp} = 0.0160\ K^{-0.8} . \qquad \text{(IV-4)}$$

An exact solution is available for the case of laminar flow [28]. Applying this to the asymptotic form of the two-dimensional momentum integral equation yields the relation

$$Re_{\delta_2}\Big|_{asymp} = 0.3467\ K^{-0.5} . \qquad \text{(IV-5)}$$

It is shown that the values predicted by the 1/7-power profile assumption are in agreement with the experimental values, whereas, the laminar values are considerably lower. On the basis of these results, unblown asymptotic boundary layer flows for values of K as high as 1.45×10^{-6} are believed to be turbulent in nature.

The shape factor corresponding to profiles in the pressure gradient region for a given run are found to attain a reasonably constant asymptotic value with the exception of the strong suction cases for $F = -0.004$.

In an attempt to obtain a correlation of shape factor with pressure gradient, the experimentally determined values are compared in Figure 30 with the shape factor correlation proposed by Simpson [17] for turbulent boundary layers. This correlation of constant free-stream velocity data is given by

$$H = \frac{1}{1 - \frac{6.2}{\zeta}} \qquad \text{(IV-6)}$$

where

$$\zeta = \frac{1}{\sqrt{C_f/2}\left[(1 + B)^{1/2} + (1 + 0.635B)^{1/2}\right]} \qquad \text{(IV-7)}$$

The present constant free-stream velocity data is also shown on this figure, indicating that this equation represents a good mean of the zero pressure gradient data even though the data scatter is relatively large.

No significant correlation of shape factor with pressure gradient can be determined. The experimental shape factors also appear to be reasonably insensitive to blowing fraction for values of F greater than or equal to -0.001. In the cases of stronger suction, the values of shape factor are found to be higher than those indicated in Figure 30 and are not shown due to the strong possibility that these boundary layers do not behave in a turbulent manner. It is also noteworthy that the shape factor correlation of Simpson is shown to yield higher values of shape factor than the experimental values presented and is, therefore, not considered applicable in such strong favorable pressure gradient flows.

The shape factor corresponding to the exact laminar solution for the unblown asymptotic layer has a constant value of 2.0 . In the present unblown data, values of shape factor on the order of 1.3 correspond to those profiles in the pressure gradient region of the duct. Hence, the unblown asymptotic boundary layer flows considered are believed to be turbulent in nature, on the basis of shape factor as well as Re_{δ_2} .

A similar comparison of Re_{δ_2} and shape factor H is not presented for the blown and sucked flows since exact laminar solutions do not exist in these cases. However, it is reasonable to conclude that the present blown boundary

layer flows are turbulent in nature, although transition to a laminar mode may occur for strong suction.

C. Shear Stress Profiles

In formulating models that represent the present mean velocity profile data, it is desirable to know the distribution of shear stress through the boundary layer. This knowledge may allow representation of the data using simple eddy-viscosity models. Neglecting X-derivatives in the inner regions of the layer, the X-direction momentum equation yields the shear stress distribution given by

$$\tau^+ = 1 + U^+ V_w^+ + p^+ y^+ \quad . \tag{IV-8}$$

Here, the dimensionless shear stress τ^+ is defined as $\tau^+ = \frac{\tau}{\tau_w}$. This distribution has been proposed by numerous investigators as representative of that in the inner regions for small pressure gradients. In the present study shear stress profiles were computed to test the applicability of equation (IV-8) in strong pressure gradients.

The following relation, developed in Chapter III, allowed the generation of shear stress profiles from the present mean velocity data where similarity in U/U_∞ vs y/δ coordinates existed.

$$\tau^+ = 1 + U^+ V_w^+ + y^+ p^+ \left[1 - \frac{1}{y} \int_o^y \left(\frac{U}{U_\infty} \right)^2 dy \right] + \\ + \frac{1}{\delta_2 \frac{C_f}{2}} \frac{dRe_{\delta_2}}{dR_x} \left[\int_o^y \left(\frac{U}{U_\infty} \right)^2 dy - \frac{U}{U_\infty} \int_o^y \left(\frac{U}{U_\infty} \right) dy \right] \tag{IV-9}$$

The resulting shear stress profiles are tabulated in Appendix A.

In Figures 31 and 32, representative shear stress profiles are compared to those obtained utilizing equation (IV-8) for the pressure gradients $K = 0.57 \times 10^{-6}$ and $K = 1.45 \times 10^{-6}$, respectively. It is observed that the maximum shear stress occurs, in all profiles presented, for values of y^+ less than 25. It is also shown that, beyond the maximum shear position, the experimentally determined profiles substantially and increasingly deviate from that given by equation (IV-8). Inasmuch as the inner regions of the layer exhibit this behavior, the shear distribution given by equation (IV-8) is found not to be applicable in semi-empirical representations of the experimentally determined profiles.

Upon comparing the relative contributions of the terms in equation (IV-9), it is found that up to $y^+ = 140$ the contribution of the non-asymptotic term is less than 2 percent. This results from the fact that asymptotic or near-asymptotic flows are considered in the present study. Neglecting the non-asymptotic term in equation (IV-9), the shear stress distribution found to closely approximate the experimental distributions in these inner regions is given by

$$\tau^+ = 1 + U^+V_w^+ + p^+y^+\left[1 - \frac{1}{y}\int_0^y \left(\frac{U}{U_\infty}\right)^2 dy\right] . \qquad \text{(IV-10)}$$

This expression is considered to be a closer approximation than equation (IV-8) even in the non-asymptotic flow cases, and is utilized in the formulation of the sublayer models presented in Chapter V.

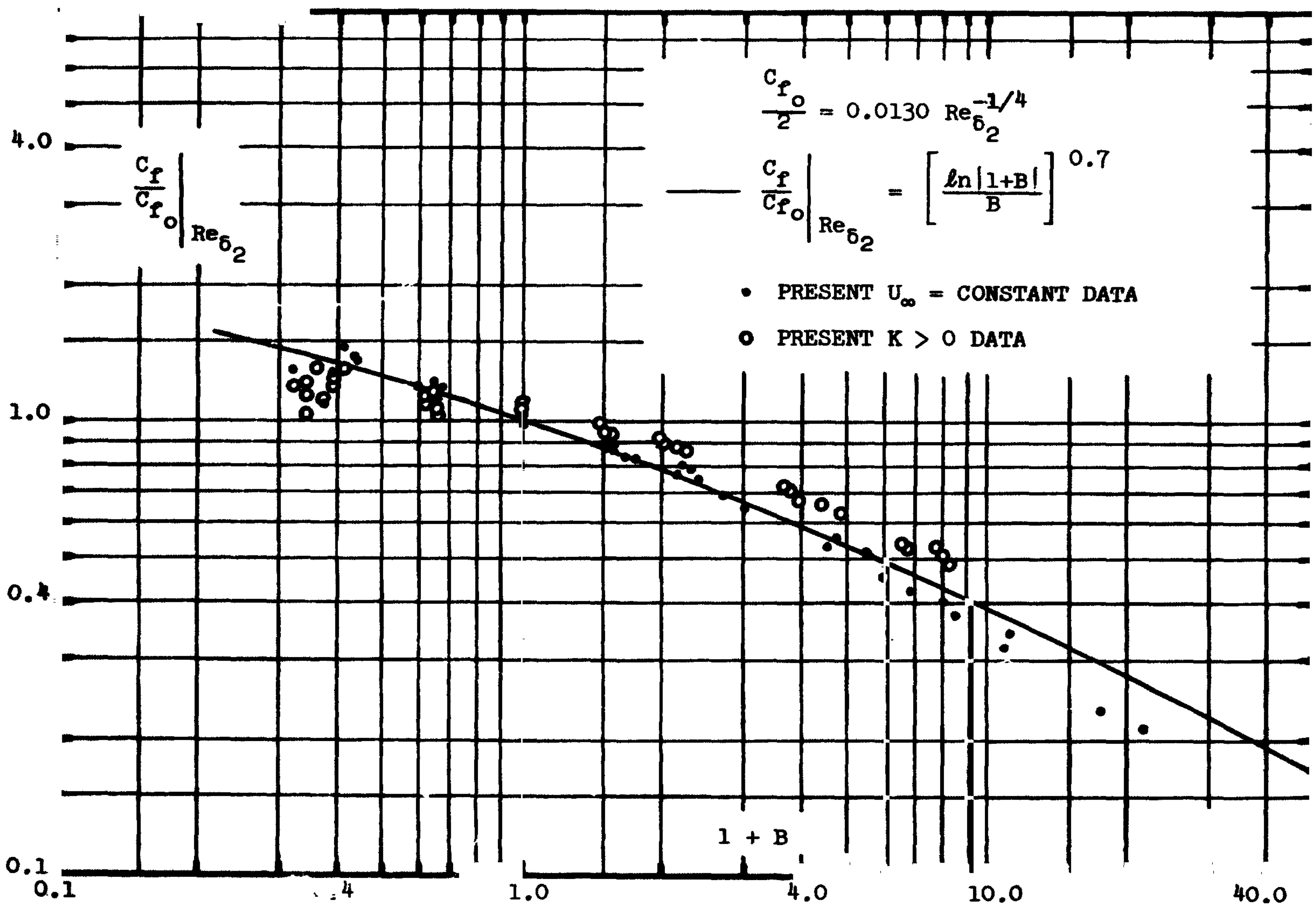

Figure 11. Comparison of $C_f/2$ with correlation of Simpson

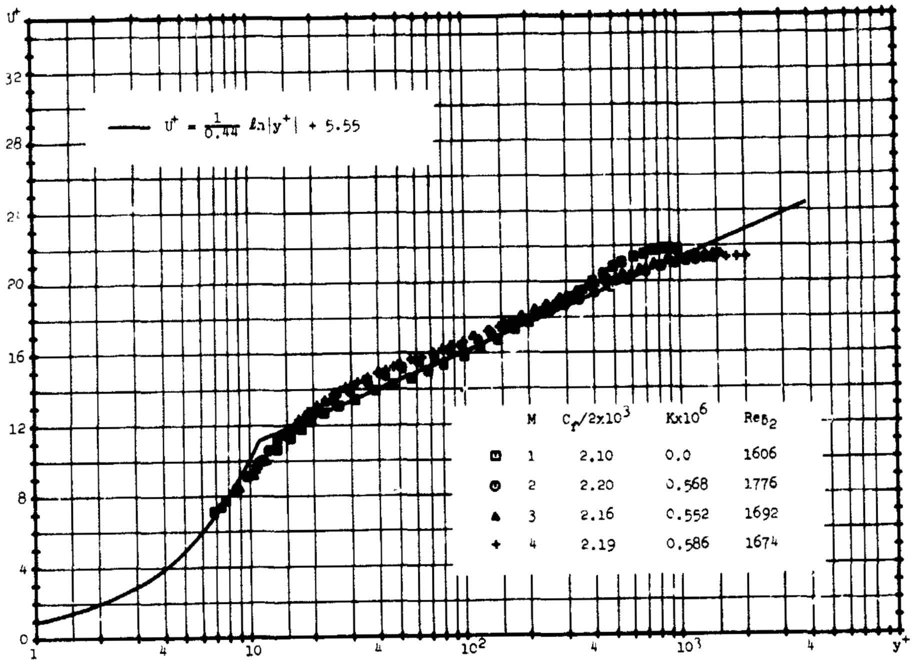

Figure 12.

U^+ vs y^+, F = 0.0 and K = 0.57 x 10^{-6}, run 51468

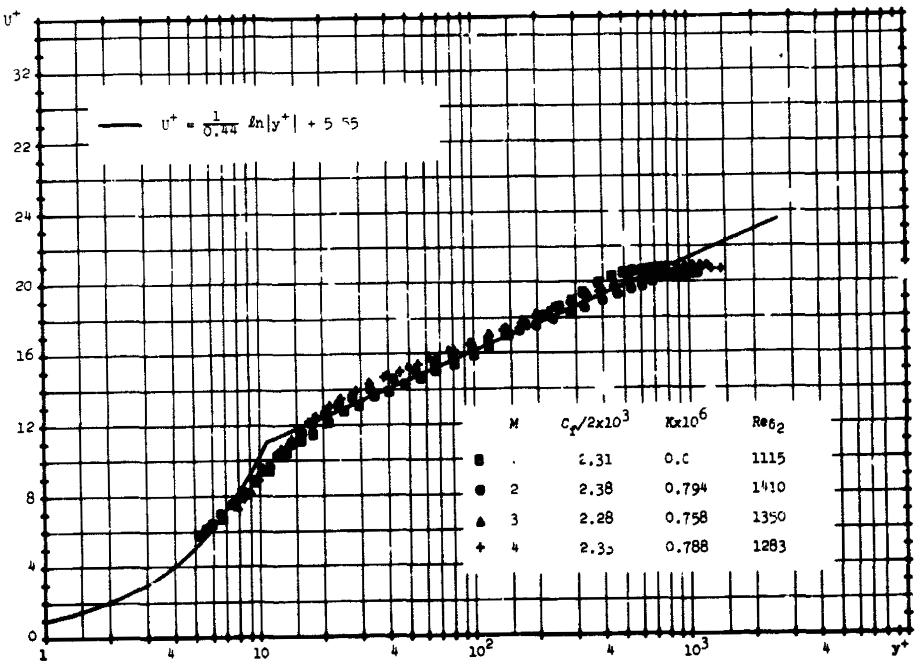

Figure 13.

U^+ vs y^+, F = 0.0 and K = 0.77 x 10^{-6}, run 51568

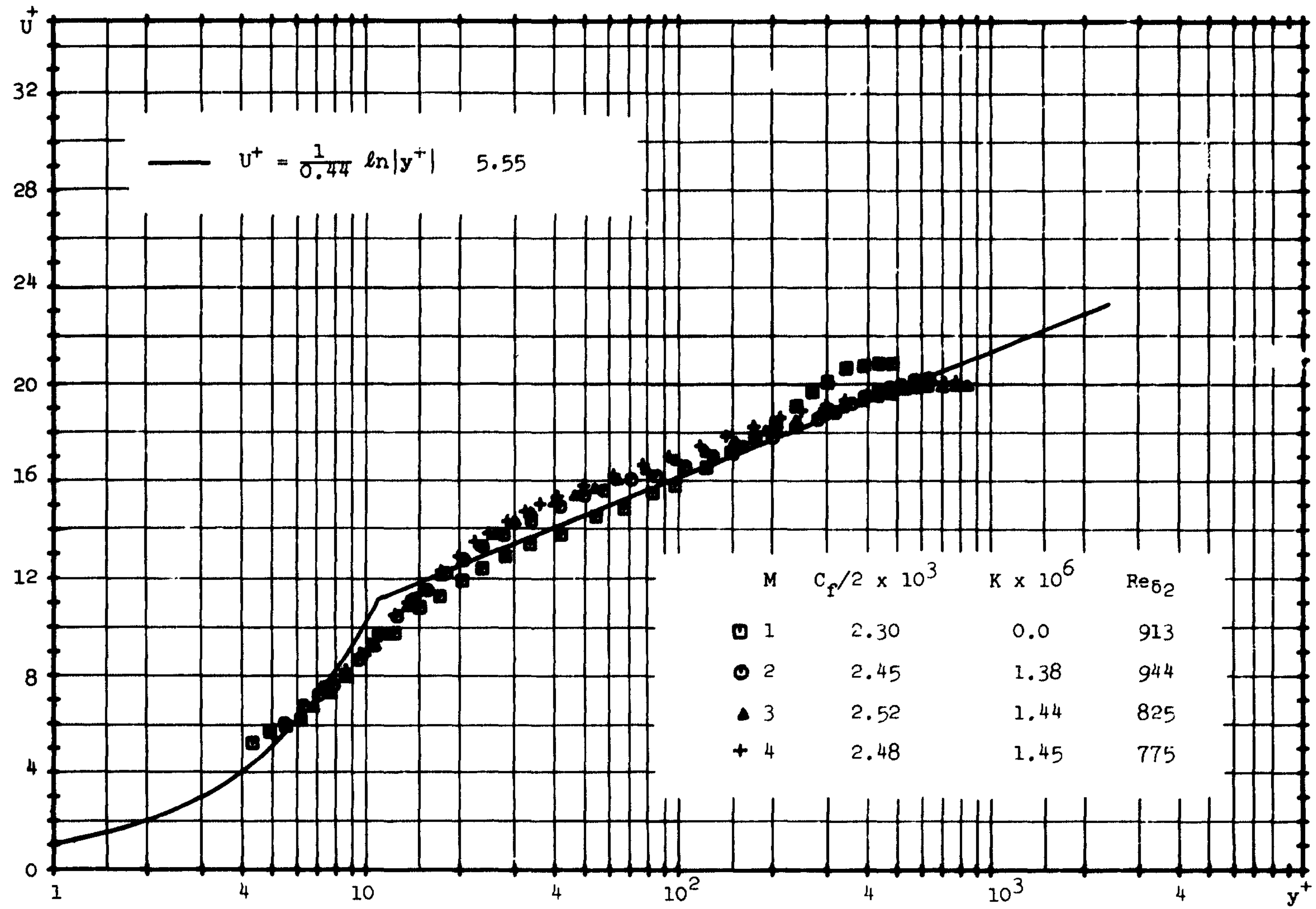

Figure 14. U^+ vs y^+, F = 0.0 and K = 1.45×10^{-6}, run 73068

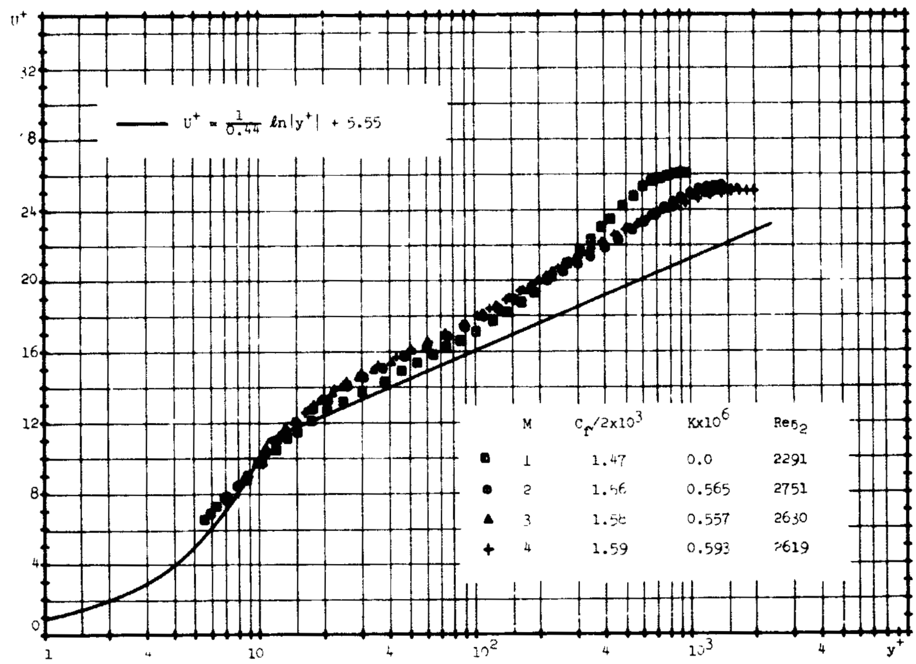

Figure 15.
U^+ vs y^+, F = 0.002 and K = 0.57 x 10^{-6}, run 42468

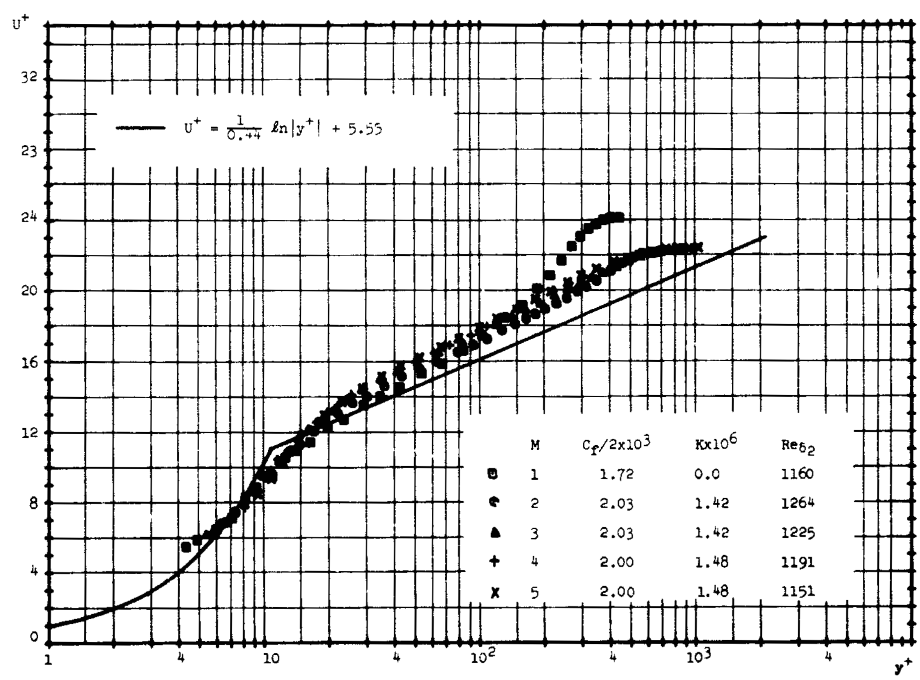

Figure 16.
U^+ vs y^+, F = 0.002 and K = 1.45 x 10^{-6}, run 81668

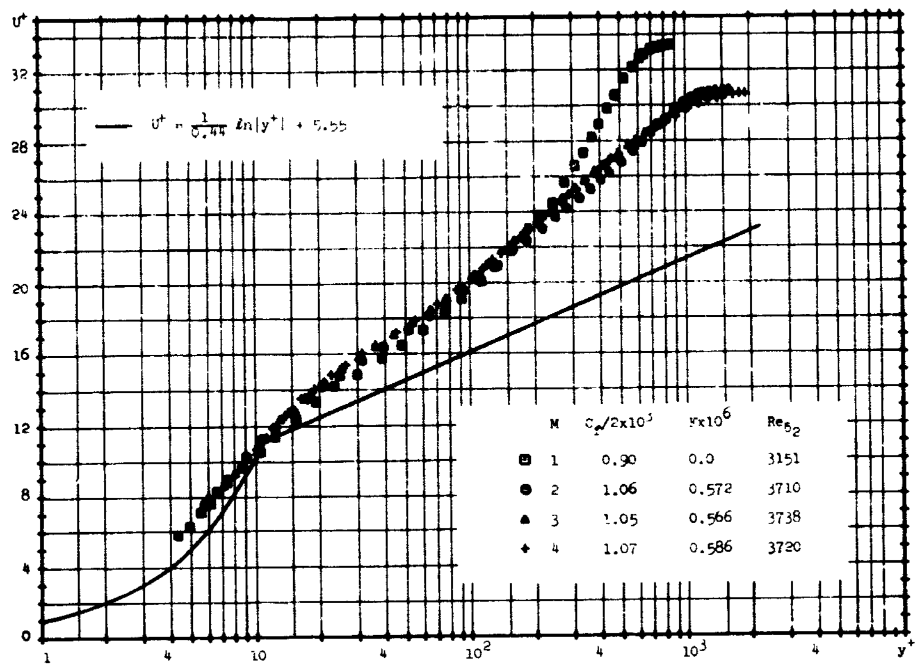

Figure 17.

U^+ vs y^+, F = 0.004 and K = 0.57 x 10^{-6}, run 41268

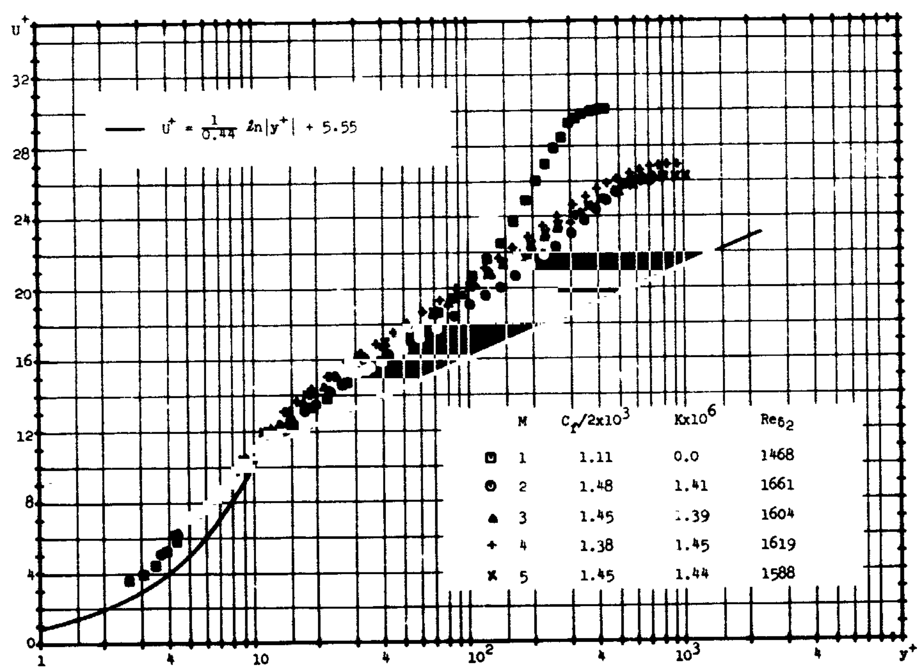

Figure 18.

U^+ vs y^+, F = 0.004 and K = 1.45 x 10^{-6}, run 82068

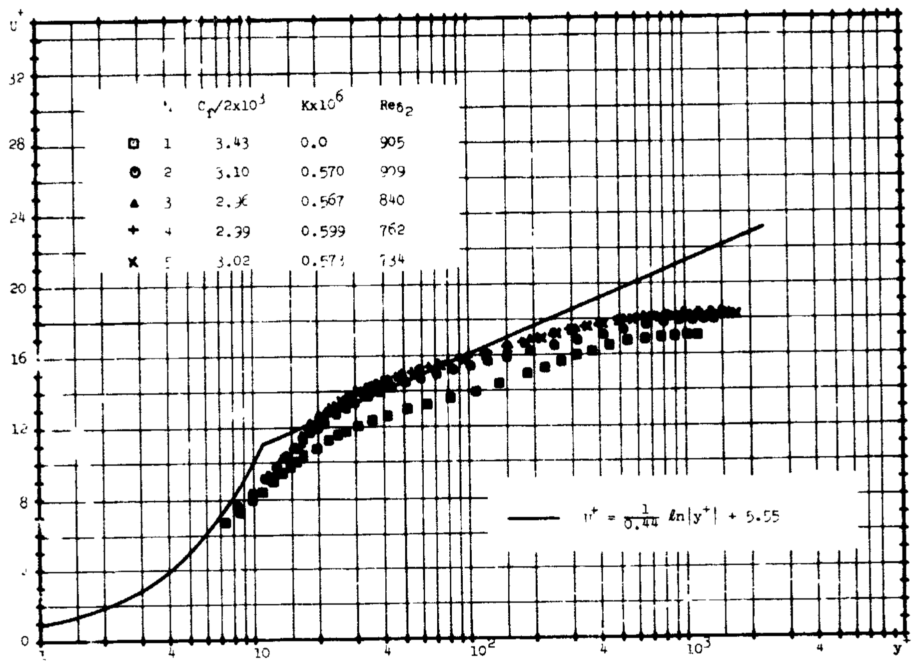

Figure 19.

U^+ vs y^+, F = -0.002 and K = 0.57 x 10^{-6}, run 52868

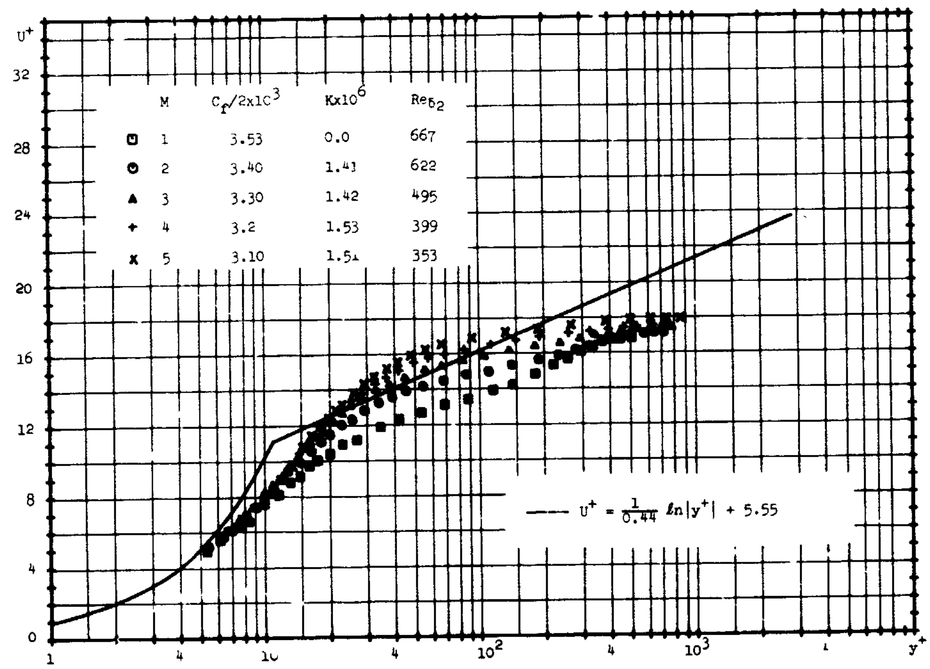

Figure 20.

U^+ vs y^+, F = -0.002 and K = 1.45 x 10^{-6}, run 80768

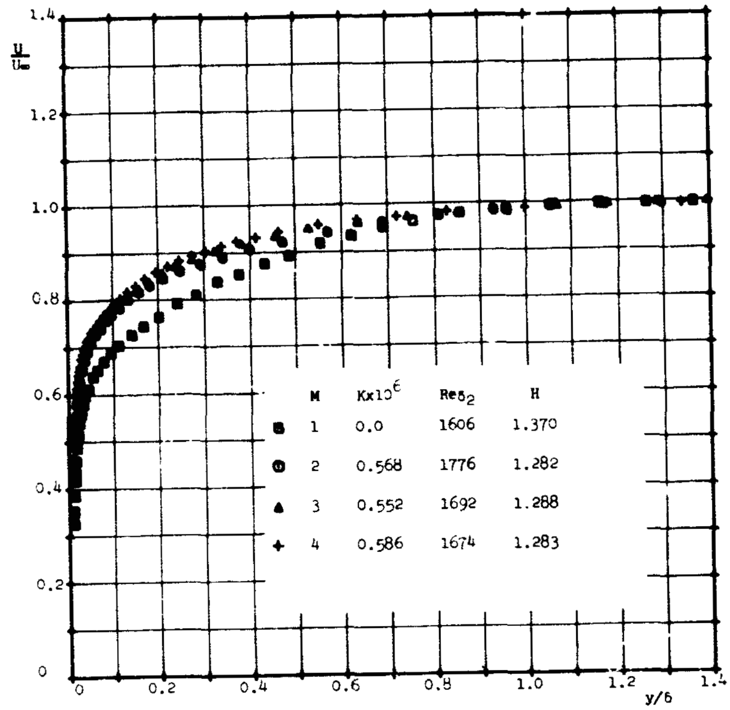

Figure 21.

U/U_∞ vs y/δ , F = 0.0 and K = 0.57 x 10^{-6}, run 51468

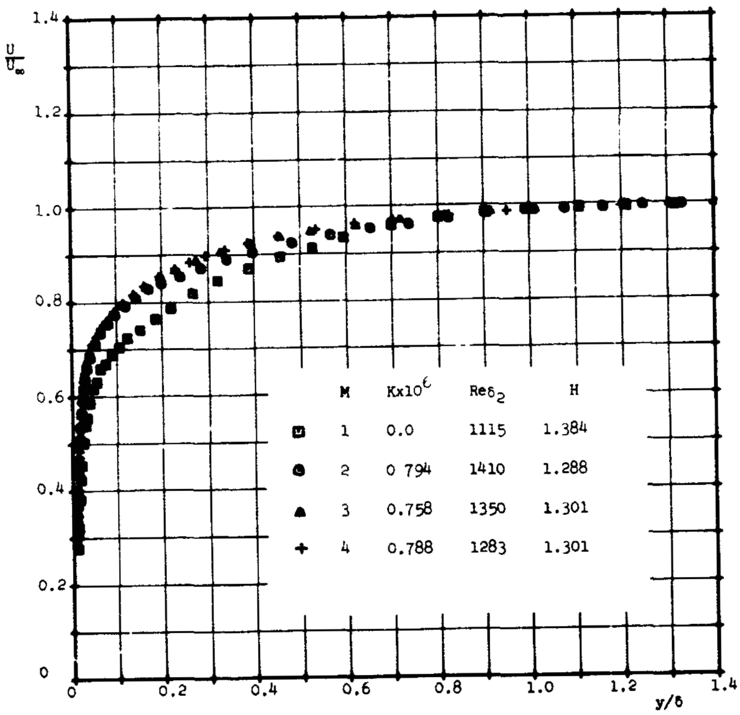

Figure 22.

U/U_∞ vs y/δ , F = 0.0 and K = 0.77 x 10^{-6}, run 51568

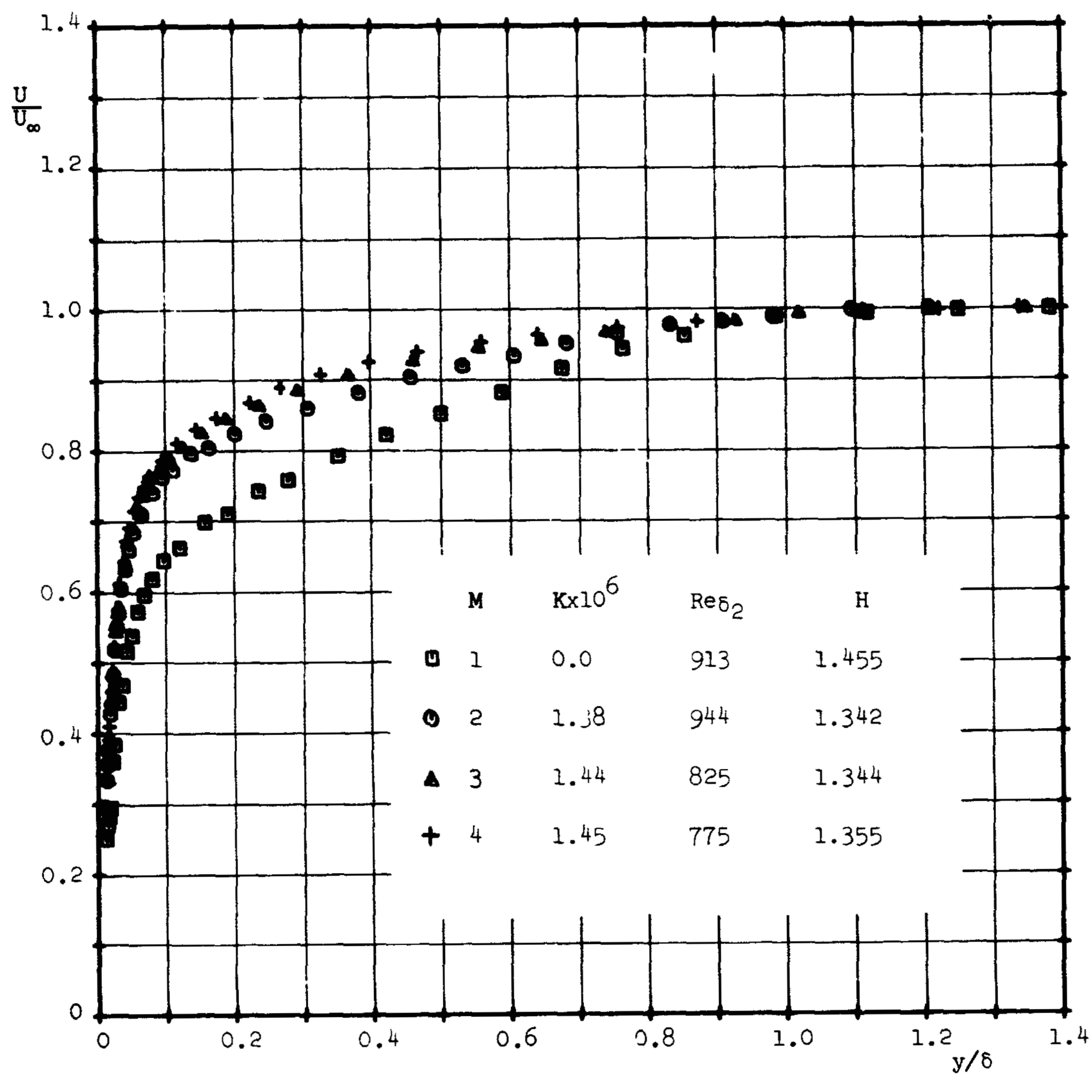

Figure 23.

U/U_∞ vs y/δ , $F = 0.0$ and $K = 1.45 \times 10^{-6}$, run 73068

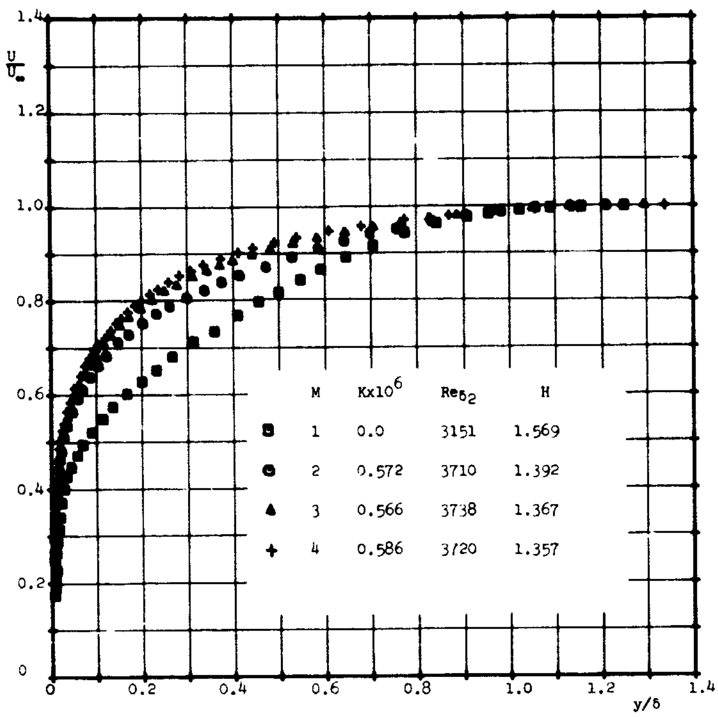

Figure 24.

U/U_∞ vs y/δ , F = 0.004 and K = 0.57×10^{-6}, run 41268

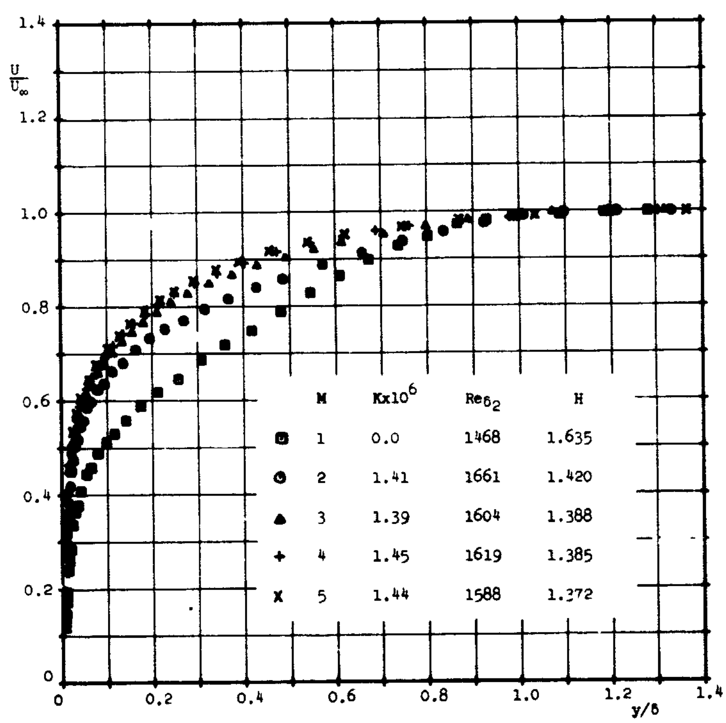

Figure 25.

U/U_∞ vs y/δ , F = 0.004 and K = 1.45×10^{-6}, run 82068

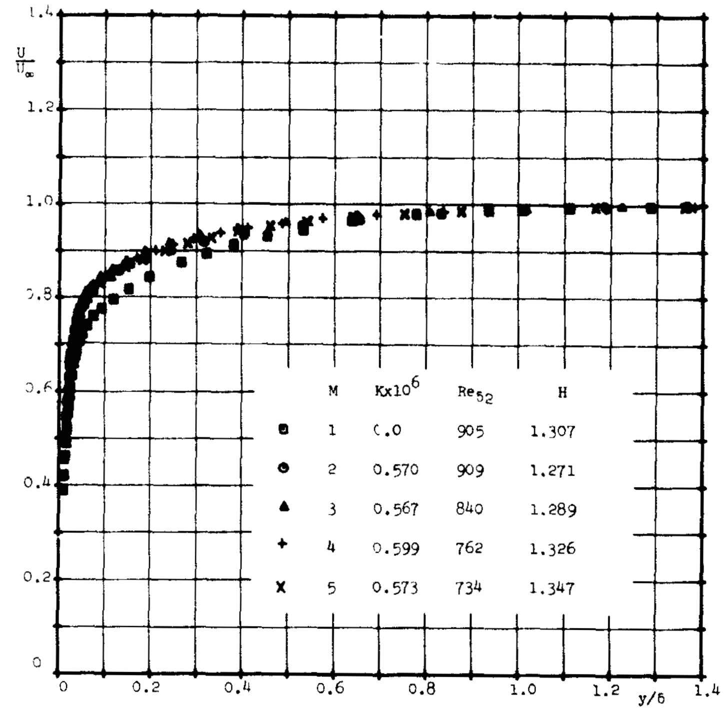

Figure 26.

U/U_∞ vs y/δ , F = -0.002 and K = 0.57 x 10^{-6}, run 52868

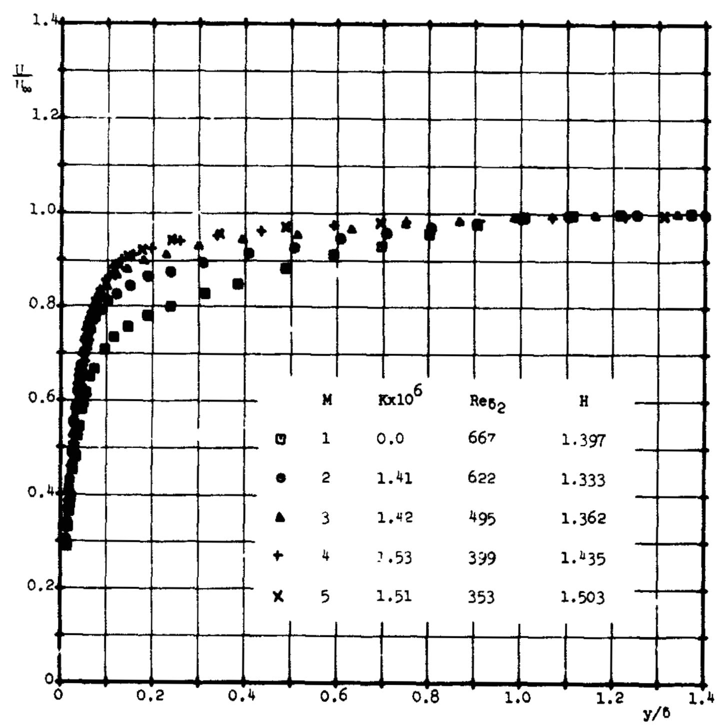

Figure 27.

U/U_∞ vs y/δ , F = -0.002 and K = 1.45 x 10^{-6}, run 80768

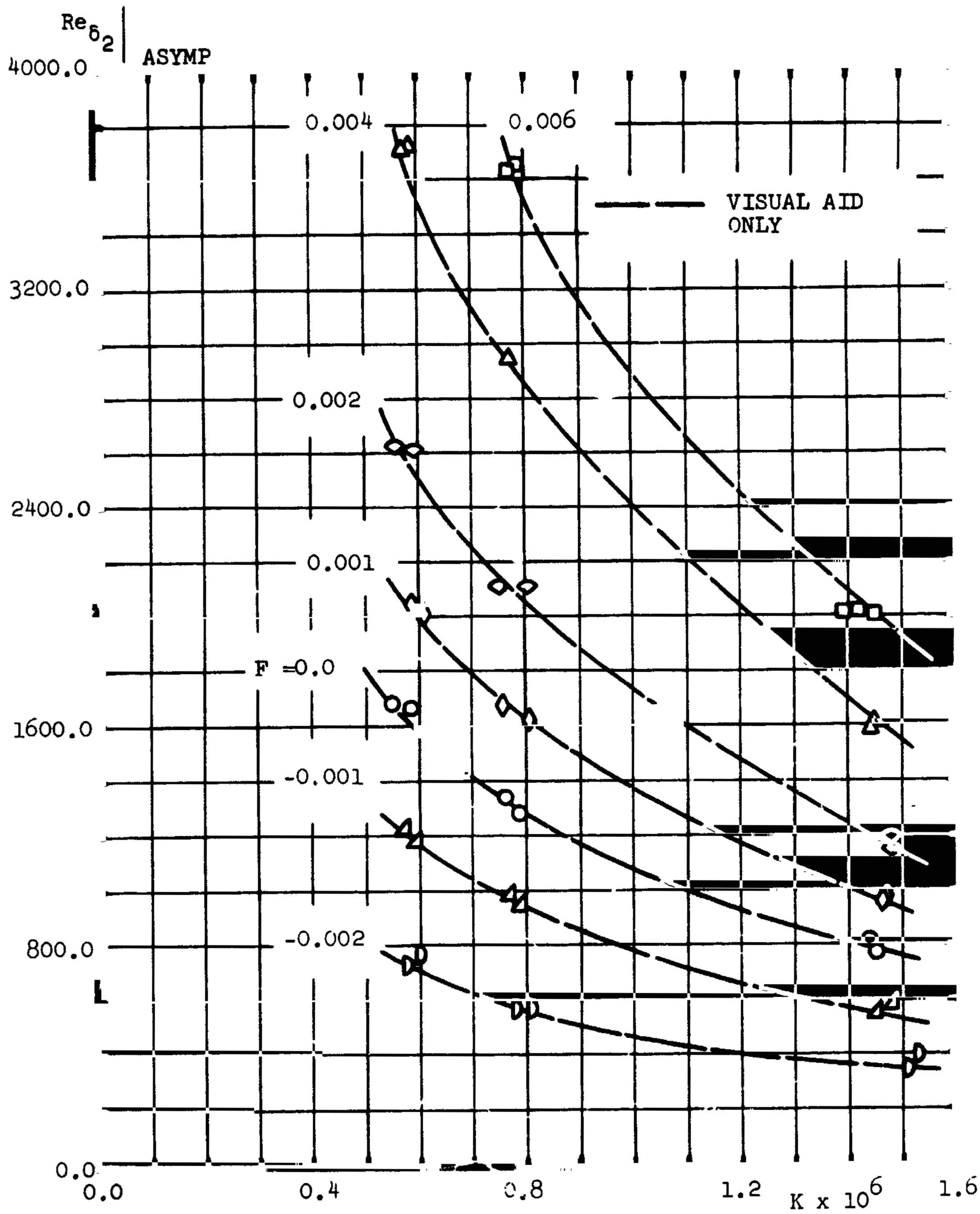

Figure 28.

Asymptotic values of Re_{δ_2} vs K

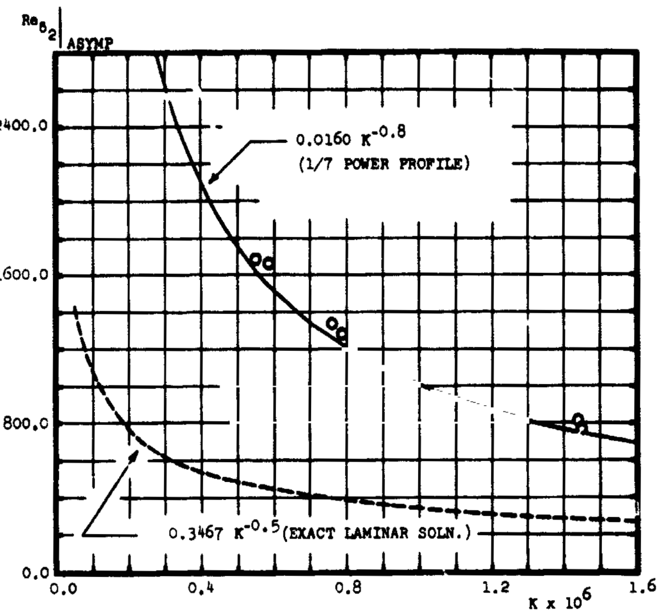

Figure 29.

Comparison of $Re_{\delta_2}|_{Asymp.}$ with turbulent and laminar predictions for unblown boundary layers

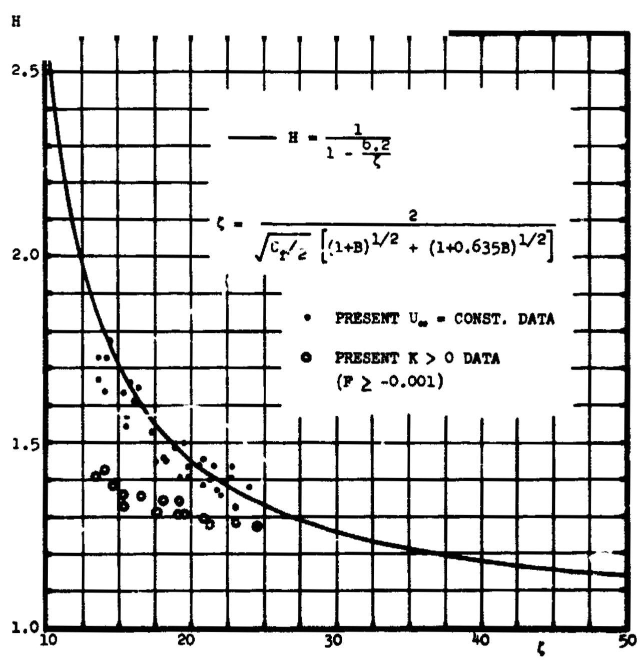

Figure 30.

Comparison of Simpson's shape factor correlation with data

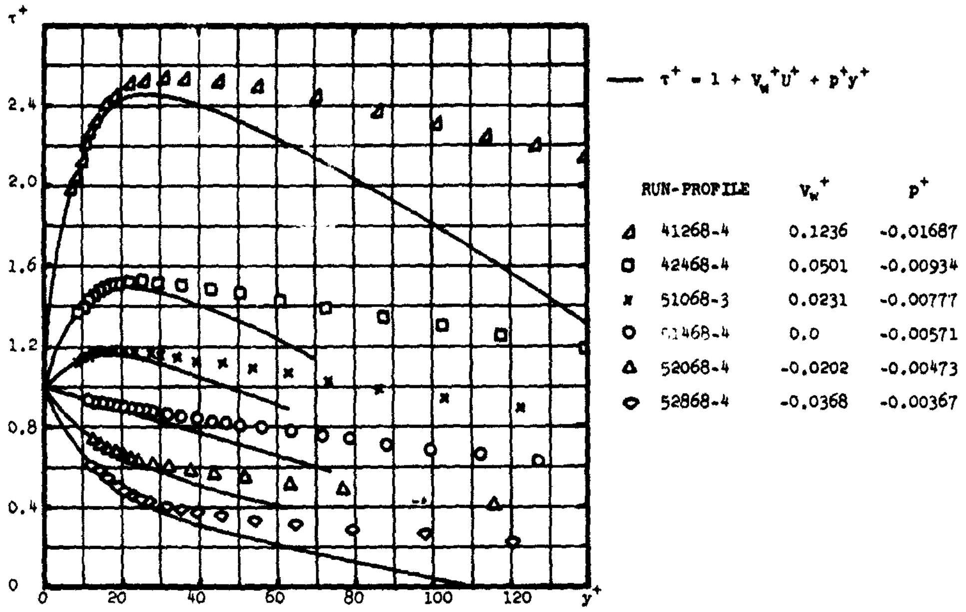

Figure 31.
Dimensionless shear stress profiles for K = 0.57 x 10^{-6}

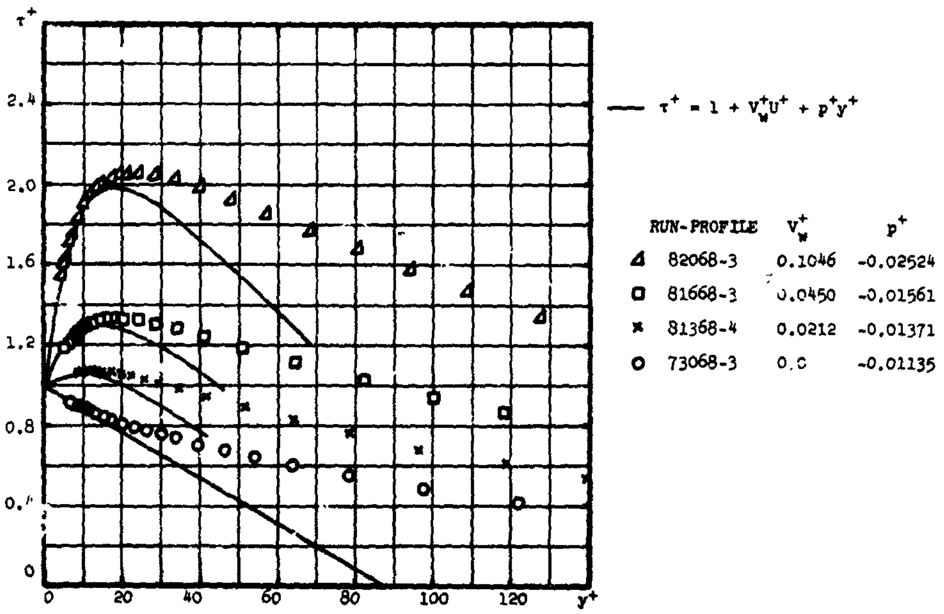

Figure 32.
Dimensionless shear stress profiles for K = 1.45 x 10^{-6}

CHAPTER V

THEORETICAL PREDICTION OF EXPERIMENTAL RESULTS

The experimental results presented in Chapter IV are restricted to near-asymptotic flows over a relatively wide range of pressure gradients and blowing fractions. It is desirable to correlate these data in such a manner that, for a first approximation, extensions can be made to non-asymptotic flows including variable boundary conditions at the surface and variable fluid properties. A finite-difference prediction program, of the Patankar-Spalding type [38], was developed for this purpose in parallel with the present experimental study. Two different semi-empirical inputs were formulated, resulting in essentially two different programs. These appear as differences in the sublayer models and the associated eddy-viscosity relations for the outer regions of the layer. One sublayer model can be described as a two-layer model whereas the other is a variation of the damped eddy-viscosity distribution proposed by Van Driest [39].

A. Patankar-Spalding Procedure

The procedure provides for the numerical solution of simultaneous parabolic differential equations which describe turbulent boundary layers and associated transport phenomena. Although the transport of energy, chemical species, etc. are considered, attention is concentrated on the transport of mass and momentum in the present application.

The boundary conditions at a solid surface are imposed by means of sublayer correlations which are patched to a finite-difference solution. This avoids the numerical difficulties inherent in regions of large velocity gradients. Conservation of mass is forced to be satisfied in this

patching procedure, as well as in the numerical solution applied to the outer regions of the layer.

The numerical procedure is advanced in the streamwise direction in an amount which depends on the amount of fluid entrained. Modifications of this entrainment procedure are available in the event additional transport phenomena is considered.

In the present application only two-dimensional boundary layer flows are considered, but the procedure itself can be extended to other flow systems. Axially-symmetric external flows, internal flows, wall jets, and jet flows are examples of the flow systems where the procedure has been used for purposes of prediction.

B. Semi-Empirical Inputs to Prediction Program

In order to have a complete set of equations to solve, empirical rate equations must be used; the specific need in the present application is the relation between effective shear stress and velocity gradient. Appropriate correlations of the present experimental data are obtained for this purpose. As indicated these physical inputs to the program are presented in the form of sublayer models and associated eddy-viscosity distributions in the outer regions of the layer. The two sublayer models are developed, and the associated eddy-viscosity relations utilized in the outer regions are described. A summary of the semi-empirical relations obtained is given in Appendix C.

B.1. Sublayer models

The turbulent contribution τ_t to the effective shear stress τ is calculated on the basis of Prandtl's mixing length hypothesis:

$$\tau_t = \rho \ell^2 \left|\frac{\partial U}{\partial y}\right| \frac{\partial U}{\partial y} \qquad \text{(V-1)}$$

The two models considered are in the form of assumed mixing length distributions.

a. Case of constant free-stream velocity

Simpson [17] has shown that the fully turbulent portion of boundary layers with blowing but no acceleration can be fitted by the bi-logarithmic law

$$\frac{2}{V_w^+}\left[(1 + U^+V_w^+)^{1/2} - (1 + 11V_w^+)^{1/2}\right] = \frac{1}{0.44}\,\ell n\left|\frac{y^+}{11}\right| \tag{V-2}$$

The form of this relation is based upon the shear stress distribution given by

$$\tau^+ = 1 + V_w^+U^+ \tag{V-3}$$

This was used in connection with equation (V-2) in arriving at mixing length distributions in the present study. In the case of suction representative profiles of Simpson, shown in Figure 33, were utilized in place of equation (V-2).

i. Two-layer model

In this model, the mixing length is assumed to have the following form in the inner regions of the layer

$$0 \leq y^+ \leq y_c^+ \qquad \ell = 0$$

$$y_c^+ < y^+ \qquad \ell = \kappa y$$

Here, the mixing length constant κ is taken to be 0.44 in order to be consistent with the results of Simpson.

The critical thickness y_c^+ at which the profiles can be considered fully turbulent is correlated with V_w^+. This was accomplished by an iterative scheme which determined the position at which equation (V-2) is satisfied simultaneously with the viscous sublayer model. In the case of suction, the values of y_c^+ were obtained by matching two representative profiles of Simpson as shown in Figure 33. Here, a Runge-Kutta procedure was utilized in the solution of the first order differential equation encountered.

The resulting correlation of y_c^+ with V_w^+ is fitted by the following equation, where $\bar{y}_c^+$ is based upon the local value of shear stress given by equation (V-3).

$$\bar{y}_c^+ = 11.0 - 18.0\ V_w^+ \qquad \text{(V-4)}$$

This simple correlation indicates a decrease in the laminar sublayer thickness with blowing and an increase with suction (in the non-dimensional sense).

ii. Continuous modified Van Driest model

The two-layer model does not properly handle that region of the profile where both laminar and turbulent viscosities are comparable, due to the inherent discontinuity in this region. For accelerated flows which are dominated by the inner regions of the layer, this has a significant effect on the prediction results. An alternative model was, therefore, considered in the present study which has a continuous distribution of mixing length. As proposed by Rotta [40], the mixing length in transpired boundary layer flows is assumed to have the distribution given by

$$0 \leq y^+ \qquad \ell = \kappa y \left[1 - \exp\left(\frac{-y^+\sqrt{\tau^+}}{A_*}\right)\right] . \qquad \text{(V-5)}$$

Here, A_* is correlated with V_w^+ . This damped mixing length was first proposed by Van Driest [38] as a good fit to impermeable flat plate data using $A_* = 26$.

Using the shear stress distribution given by equation (V-3), the required correlation of A_* with V_w^+ was obtained by matching the resulting velocity profiles in the fully turbulent region with those predicted by means of the two-layer model. The resulting correlation is given by

$$A_* = \begin{cases} 26.0 - 88.0\, V_w^+ + 110.0\, (V_w^+)^2 & V_w^+ \geq 0 \\ 26.0 - 88.0\, V_w^+ + 210.0\, (V_w^+)^2 & V_w^+ \leq 0 \end{cases} \tag{V-6}$$

The better agreement, with the experimental profiles, obtained with this continuous relation relative to that found with the two-layer model is shown by the data matching comparison given in Figure 32 for the suction data of Simpson [17].

b. Effect of acceleration

In both models, the effect of acceleration is assumed to be linear in terms of the pressure gradient parameter p^+ for a given value of V_w^+ . Hence, the assumed forms of the desired correlations are given by

$$\bar{y}_c^+ = \bar{y}_c^+\Big|_{p^+=0} \left[1 - Q_y(V_w^+)p^+\right] \tag{V-7}$$

and

$$A_* = A_*\Big|_{p^+=0} \left[1 - Q_*(V_w^+)p^+\right] . \tag{V-8}$$

The functions $Q_y(V_w^+)$ and $Q_*(V_w^+)$ were determined from the present experimental data.

Eighteen experimental profiles, representing the characteristics of the boundary layer flows presently considered, were used to determine $Q_y(V_w^+)$ and $Q_*(V_w^+)$. The flows in which similarity was not attained in the inner regions were not considered.

As indicated in Chapter IV, the shear stress distribution in strongly accelerated flows is best approximated by the following equation

$$\tau^+ = 1 + U^+V_w^+ + p^+y^+\left[1 - \frac{1}{y}\int_0^y \left(\frac{U}{U_\infty}\right)^2 dy\right] \qquad \text{(V-9)}$$

Utilizing this relation and the assumed forms of the Prandtl mixing length distributions, the experimental profiles were matched in the fully turbulent region by an iterative determination of the required values of $\tilde{y}_c^+$ and A_* . The experimental profiles and corresponding distributions in accordance with the two-layer model and continuous model are presented in Figures 34 through 40. The required values of $\tilde{y}_c^+$ and A_* are also presented with each profile.

The continuous model gives the closest approximation to the data in the region near the wall ($y^+ < 70$), as anticipated. The experimental data are bracketed by the different models in this region. The prediction of the experimental profiles with the continuous model is also shown to improve with blowing.

The values of $Q_y(V_w^+)$ and $Q_*(V_w^+)$ corresponding to these data are presented as a function of V_w^+ in Figures 41 and 42, respectively. The continuous distributions fitted to these values are also present in the corresponding figure.

The scatter of the profile values about these assumed distributions appears to be quite large due to the expanded scale utilized. The deviations indicated are still within the experimental uncertainty of the data.

Equations (V-7) and (V-8) are utilized in the present prediction of these data, with the functions $Q_y(V_w^+)$ and $Q_*(V_w^+)$ being given by the continuous distributions indicated in Figure 41 and 42, respectively. The shear stress distribution given by equation (V-9) is also assumed to apply in the inner regions of the layer not computed by means of the finite-difference procedure.

These correlations reduce to the zero pressure gradient cases for $p^+ = 0$. In the event that $V_w^+ = 0$ and $p^+ = 0$, the flat plate "law of the wall" is obtained with both models and associated correlations. Hence, these sublayer relations are consistent with accepted turbulent boundary layer behavior in the more restrictive flow systems.

B.2. Eddy-viscosity distributions in outer regions

The assumed mixing length distributions applied to the inner regions of the boundary layer obviously cannot be extended to the outer regions. It is, therefore, necessary to assume a different form of the mixing length distribution in the outer region.

Escudier [40] found that in a variety of boundary layer flows the mixing length distribution can be fitted by the relations

$$\begin{aligned} y/\delta &\leq \lambda/\kappa \qquad \ell = \kappa y \\ y/\delta &> \lambda/\kappa \qquad \ell = \lambda\delta \end{aligned} \tag{V-10}$$

Here, the quantity λ is taken to be a constant whose suggested value is 0.09. A similar truncation of the mixing length is utilized in the present predictions.

The eddy-viscosity data of Simpson [41] obtained for a wide range of blowing conditions indicates that λ should not be considered a constant for low values of Re_{δ_2} . A better approximation is given by the relation

$$\lambda = 0.25\, Re_{\delta_2}^{-0.125} \qquad \text{(V-11)}$$

for $Re_{\delta_2} < 5600.0$. For larger values of Re_{δ_2} , it is suggested that λ be truncated at a value of 0.085 .

In connection with the two-layer model, the mixing length distribution given by equations (V-10) is utilized. The parameter λ is also taken to be a function of Re_{δ_2} as indicated. In addition, it was found necessary to apply a blowing correction to equation (V-11) in order to accurately match the theoretical profiles with experimental profiles in the prediction of highly blown boundary layer flows. The resulting relation utilized for λ is given by

$$\lambda = 0.25\, Re_{\delta_2}^{-0.125}[1 - 67.5F] \qquad \text{(V-12)}$$

where λ is again truncated at a value of 0.085 .

In the continuous model the mixing length distribution assumed is given by

$$y/\delta \leq \lambda/\kappa \qquad \ell = \kappa y\left[1 - \exp\left(\frac{y^+\sqrt{\tau^+}}{A_*}\right)\right]$$

$$y/\delta > \lambda/\kappa \qquad \ell = \lambda\delta \qquad \text{(V-13)}$$

Here, λ is also assumed to very with Re_{δ_2} and F in the manner utilized in the two-layer model.

C. Prediction of Constant Free-Stream Velocity Data of Simpson

The present program was used to predict the constant free-stream velocity data of Simpson [17] in order to check the program. The constant blowing fraction runs considered consist of two blowing runs, an impermeable wall run, and a suction run.

In order to demonstrate the similarity obtained between experimental and theoretical profiles, the theoretical profiles predicted for flow over an impermeable flat plate are presented in Figure 43. These U^+ vs y^+ profiles, corresponding to the two-layer, model are shown to be "normal" and acceptable; similar profiles are obtained with the continuous model.

In Figure 44, the friction factors predicted for all zero pressure gradient runs considered are compared with the experimental data. The values of $C_f/2$ predicted by the two-layer model and continuous model are shown to agree with the experimental values at corresponding values of Re_{δ_2}. For the highest blowing run, slight deviations are noted but in considering the degree of experimental uncertainty in these data the deviations are found to be acceptable.

It is concluded that the prediction program yields acceptable results in zero pressure gradient flows.

D. Prediction of Present Experimental Results

D.1. Initial profile input

The Patankar-Spalding procedure requires an initial velocity profile and initial profiles for additional transported quantities considered. For prediction of the present data, 1/7-th power velocity profiles were assumed for this purpose in all cases. The corresponding thickness of the boundary layer was chosen such that the predicted momentum thickness coincided with that experimentally obtained value at a given station in the constant free-stream velocity approach region

of the duct. This matching of momentum thickness was made in the impermeable wall cases and the corresponding initial profile was assumed to be invariant with blowing or suction. This approach was considered reliable in that computations were begun at the upstream edge of the porous region where the layer has yet to adjust to the blowing or sucking condition imposed.

D.2. Input of blowing rates and free-stream velocity distributions

It is necessary to stipulate the boundary conditions corresponding to the boundary layer flow to be predicted. The asymptotic and near-asymptotic boundary layer flows of interest were characterized by constant values of K and F chosen to fit the associated experimental distributions.

The free-stream velocity distribution was determined by means of analytical expressions representing the streamwise distributions of the parameter K . The initial value of the free-stream velocity corresponded to that experimentally determined for the constant free-stream velocity approach region of the duct. Sinusoidal distributions for K were used to proceed from one constant K region to another in a continuous manner.

The mass flux at the wall was described by analytical expressions so that the required constant blowing fraction was maintained with the associated free-stream velocity distribution.

D.3. Comparison of prediction with data

The theoretical predictions of H , Re_{δ_2} , and $C_f/2$ for the present data are compared with the experimentally determined values in Figures 45 through 54. These quantities are presented as functions of the distance from the upstream edge of the porous section. The assumed distributions of the pressure gradient parameter K are presented in all cases,

and for the data runs where $K = 1.45 \times 10^{-6}$, the resulting free-stream velocity distribution is also compared with the experimental values at the given traverse stations.

With the exception of runs 42468, 52868, and 80768, the theoretical predictions for both models are found to be good. In all the predictions, with those exceptions noted, the trends of the data are distinctly represented and the agreement with the data in terms of H and $C_f/2$ is within the calculated experimental uncertainty of these parameters. The associated predictions of Re_{δ_2} are also acceptable for most engineering purposes.

For run 42468 (where $K = 0.57 \times 10^{-6}$ and $F = 0.002$), the predictions are shown in Figure 47 to underestimate the value of $C_f/2$ at the traverse station in the approach region of the duct. The experimental value of $C_f/2$ at this value of Re_{δ_2} is found to agree with the corresponding $C_f/2$ data of Simpson [17]; therefore, it is suggested that this discrepancy is the result of insufficient adjustment of the initial profile. For run 52868 (where $K = 0.57 \times 10^{-6}$ and $F = -0.002$), a similar discrepancy is shown to exist in Figure 50. Here, the theoretical predictions of $C_f/2$ are found to be in close agreement with the corresponding data of Simpson; this discrepancy is not considered to be the result of inadequate data correlations.

Run 80768 (where $K = 1.45 \times 10^{-6}$ and $F = -0.002$) is shown in Figure 54. An adequate prediction of this case was not excepted with the present program. The experimental profiles are known to have different characteristics than those required by the semi-empirical models utilized. It is presented here only to indicate the limited range of each physical model proposed. The two-layer model would not function at all in the presence of such strong pressure gradients. The continuous model did allow prediction of the experimental data but poor agreement was obtained as indicated.

An obvious comparison to be made is that of the relative merits of the two sublayer models proposed. In the prediction of Re_{δ_2}, the models yield similar results whereas deviations are observed between the two for H and $C_f/2$. The continuous model yields the closest estimate of shape factor H as expected due to its good agreement with the experimental profiles. The two-layer model is found to yield the closest estimates of $C_f/2$ in the pressure gradient flows. Friction factors are equally well predicted by both models in the zero pressure gradient regions.

In conclusion, it is found that in terms of an overall prediction one model does not yield superior results relative to the other. If either H or $C_f/2$ are of major importance, the appropriate model should be utilized.

The development of Re_{δ_2} is overpredicted in the recovery region (constant free-stream velocity) for the strongest acceleration. Upon inspection of the prediction results, it was found that a momentum unbalance exists in the prediction for this region of the flow whereas conservation of momentum is satisfied in all other regions.

E. Summary of Results

Theoretical predictions of the present data were obtained with the Patankar-Spalding procedure [38] using semi-empirical eddy-viscosity relations. Two eddy-viscosity models were considered using Prandtl's mixing length hypothesis. The inner regions of the boundary layer in one are represented by a two-layer model and in the other by a continuous modified Van Driest model. The outer regions are represented by means of a truncation of the mixing length. The effects of transpiration and acceleration are incorporated in terms of the parameters V_w^+ and p^+, respectively, in the inner regions. The bi-logarithmic "law of the wall" proposed by Simpson [17], the suction data of Simpson, and the present asymptotic and

near-asymptotic boundary layer flow data were used to formulate these models.

Theoretical predictions of experimental constant blowing fraction runs of Simpson in zero pressure gradients are found to be acceptable.

The theoretical predictions of the present pressure gradient data are similarily found to be acceptable, except in those cases where the turbulent models were known a priori not to apply according to the present data. It follows that the proposed models are reliable for prediction purposes in these types of flows.

In terms of an overall prediction both models appear equally useful. The continuous model yields the best estimates of shape factor whereas the two-layer model yields the best estimates of friction factor.

Some physical implications of the successful prediction of these data with such simple models are noteworthy Implicit in these models are the effects of transpiration and pressure gradients on the increase or decrease of eddy-viscosity near the wall. Although these effects are coupled, the same qualitative behavior is found in those cases where either transpiration or acceleration are considered separately. In addition, these are turbulent models which suggests that the present flows can be considered turbulent in nature, except in those cases of suction, noted in Chapter IV, where substantial structural changes are suggested in the inner regions of the layer.

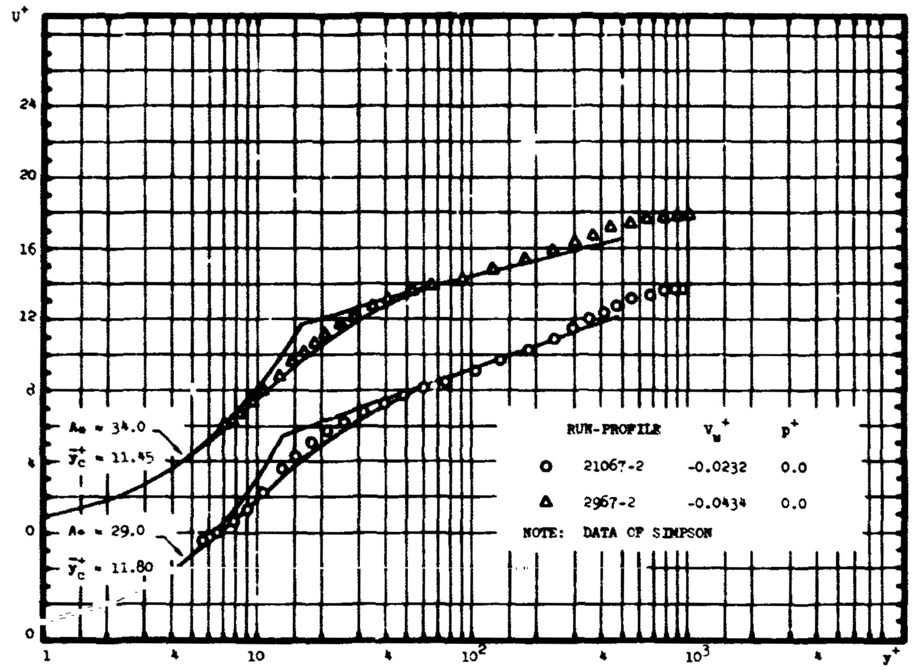

Figure 33.
Velocity profiles for cases of suction at wall

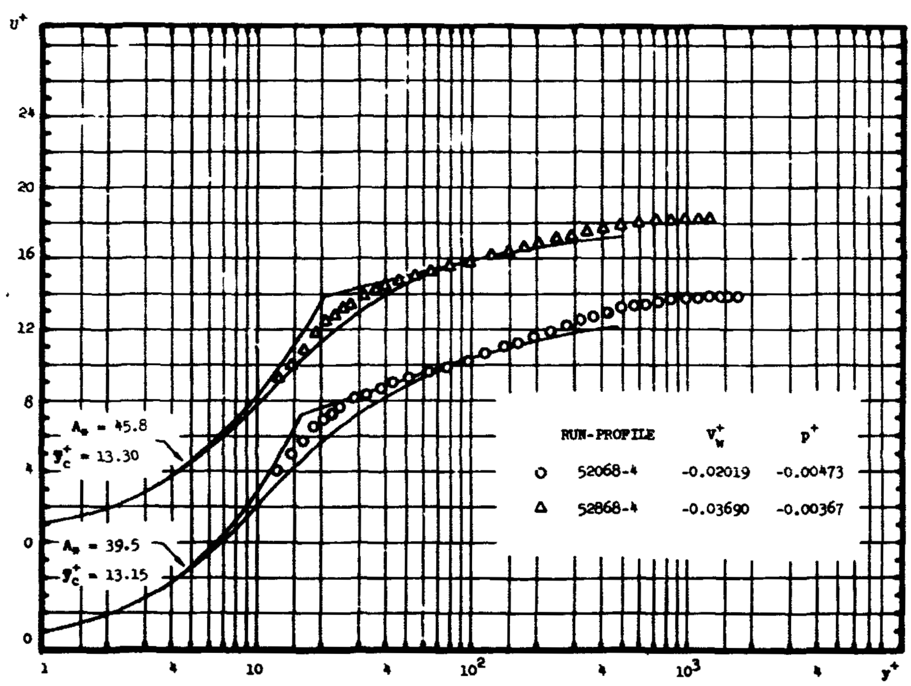

Figure 34.
Velocity profiles for cases of suction at wall

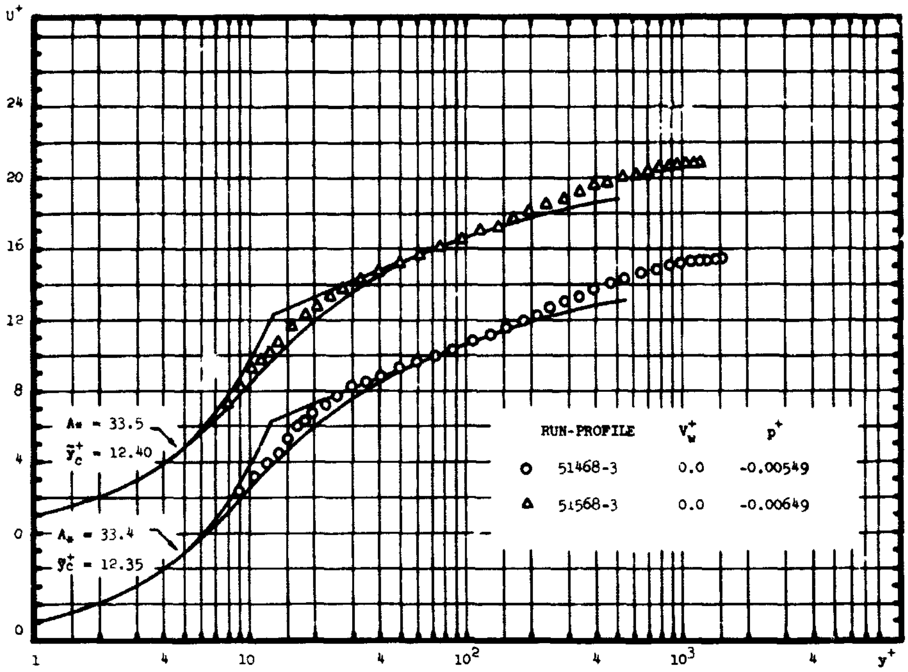

Figure 35.

Velocity profiles for impermeable wall cases

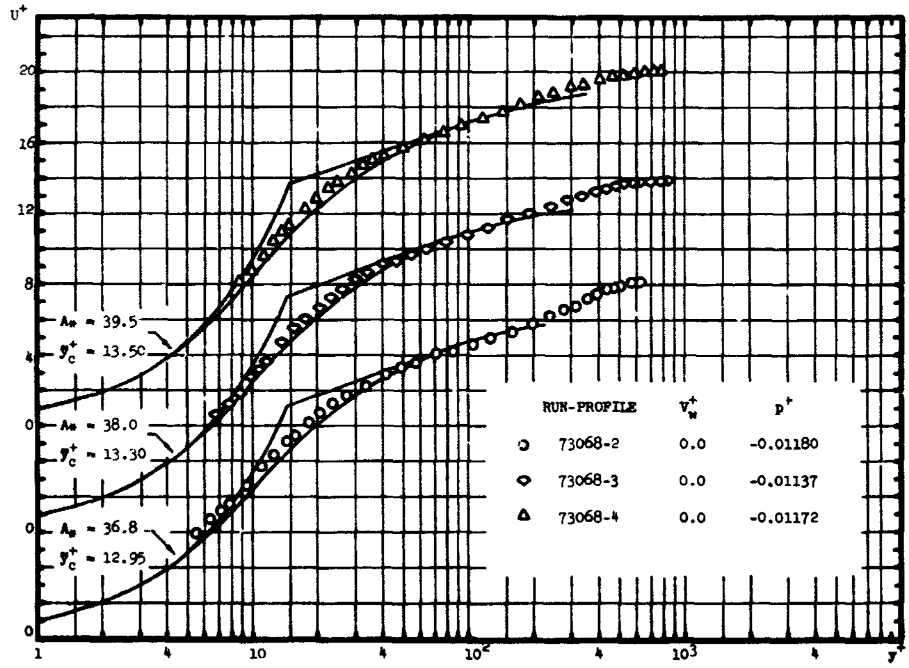

Figure 36.

Velocity profiles for impermeable wall cases

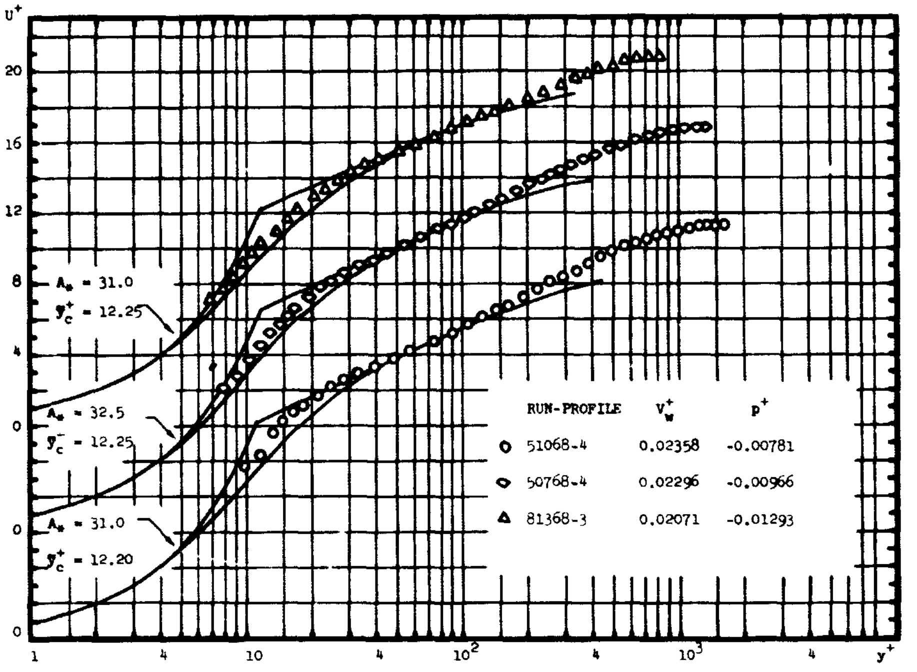

Figure 37.

Velocity profiles for cases of blowing at wall

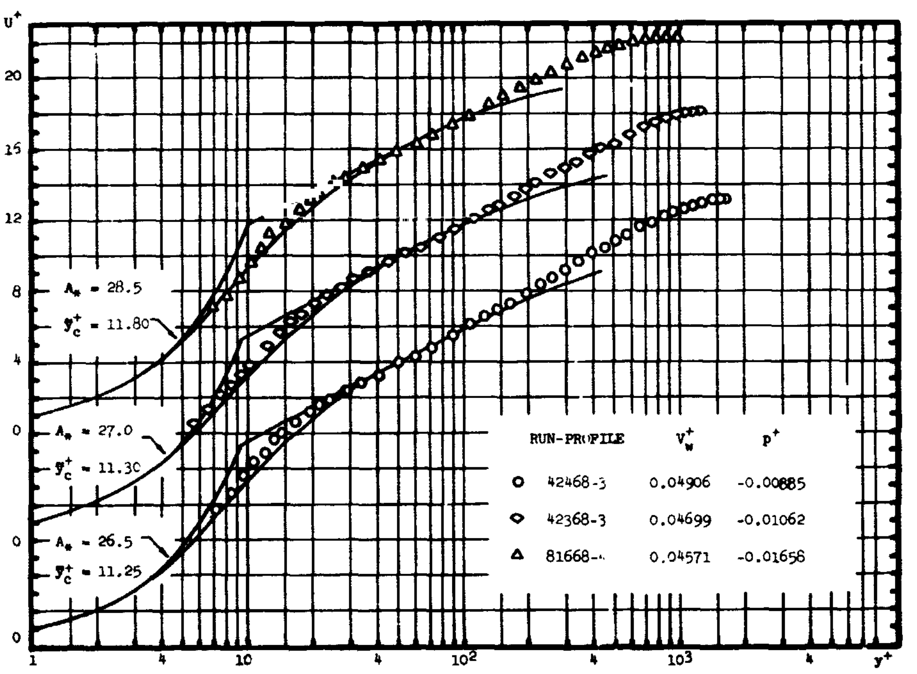

Figure 38.

Velocity profiles for cases of blowing at wall

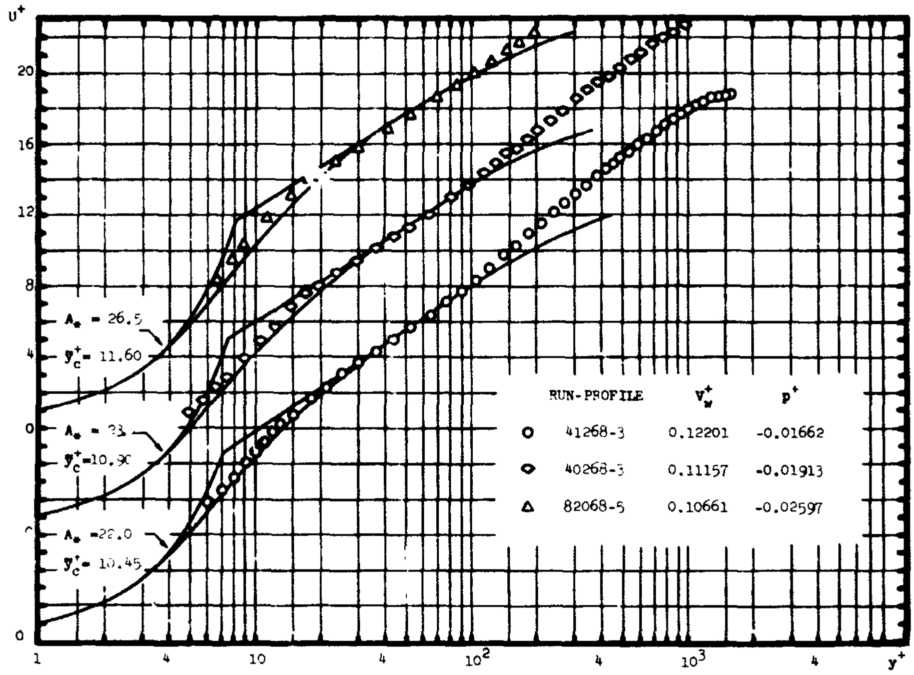

Figure 39.
Velocity profiles for cases of blowing at wall

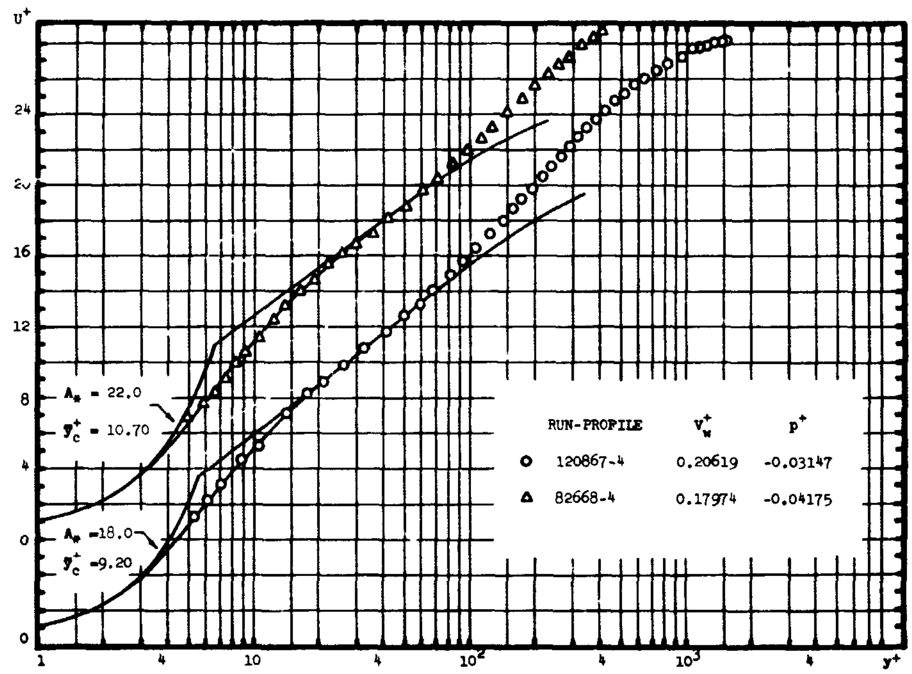

Figure 40.
Velocity profiles for cases of blowing at wall

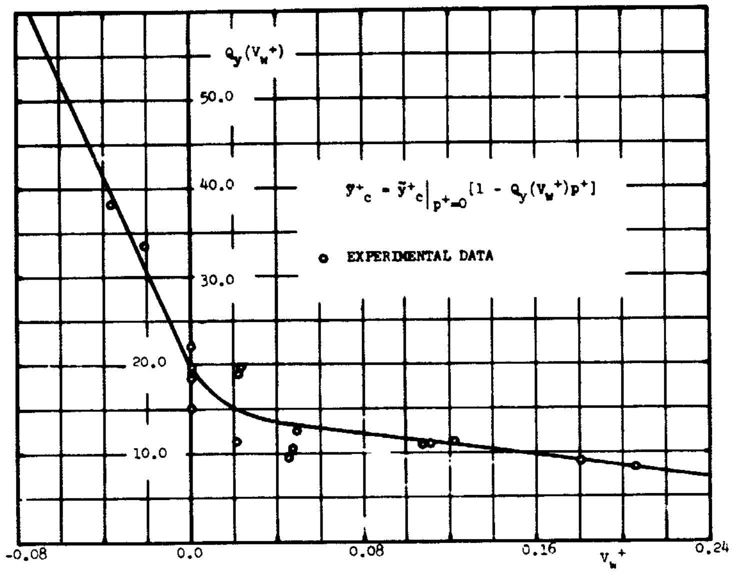

Figure 41.

Correlation of $Q_{\tilde{y}}$ with V_W^+

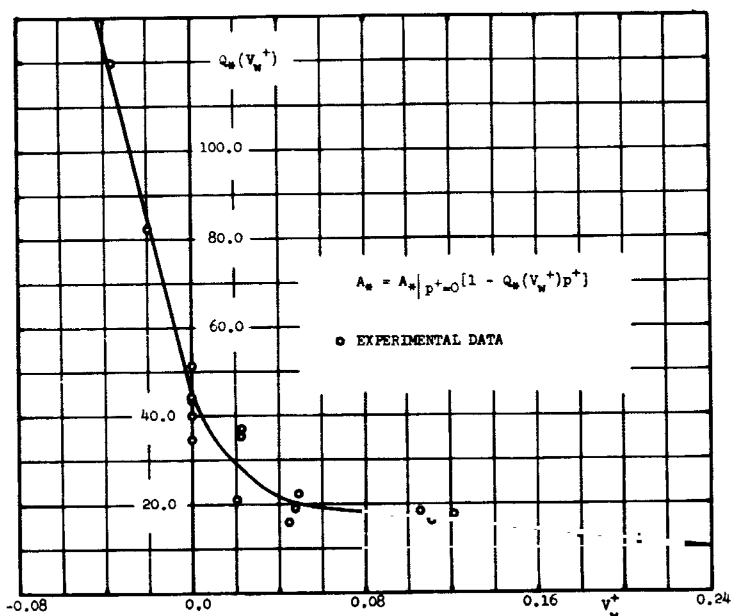

Figure 42.

Correlation of Q_* with V_W^+

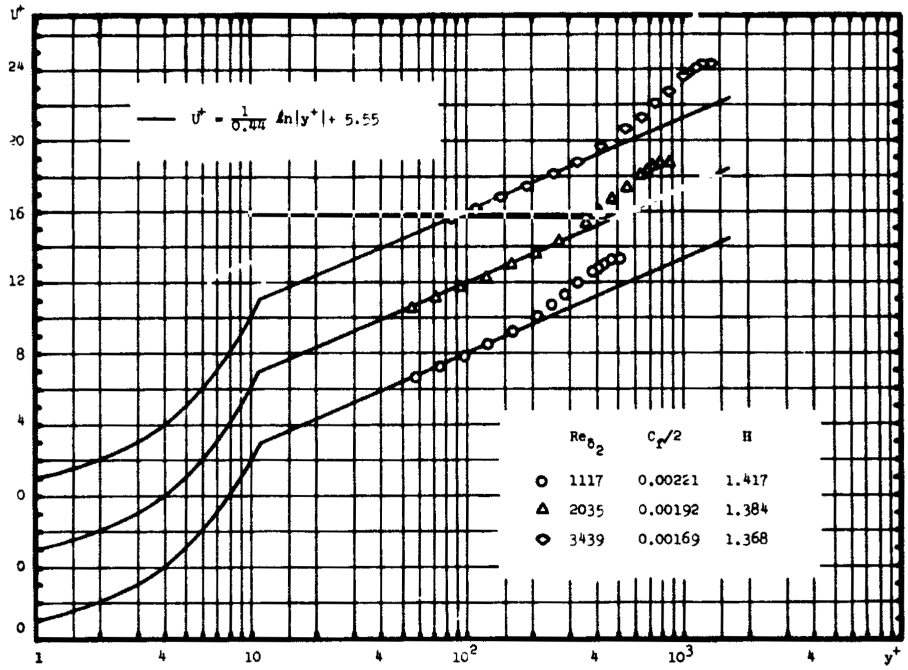

Figure 43.

Predicted U^+ vs y^+ profiles for impermeable flat plate utilizing 2-Layer model

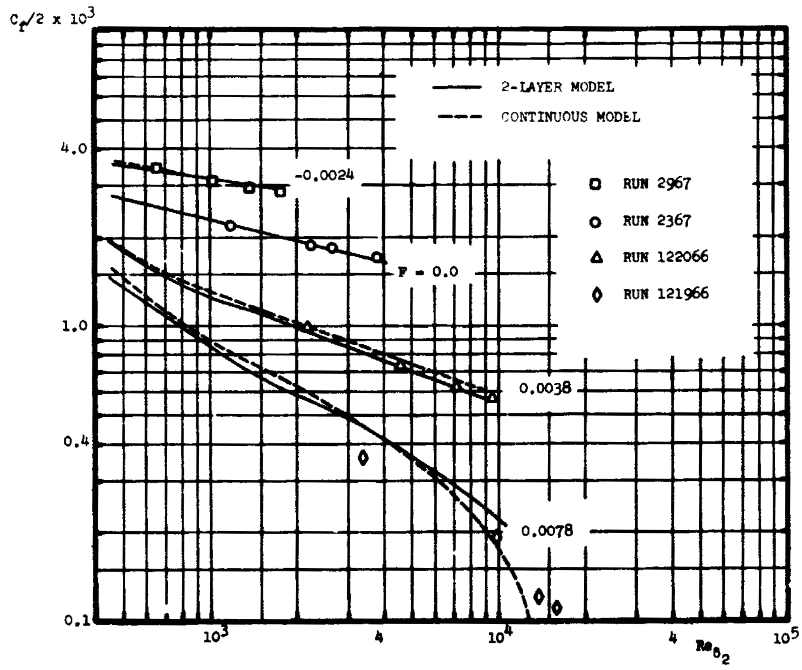

Figure 44.

Prediction of $c_f/2$ vs Re_{δ_2} according to data of Simpson

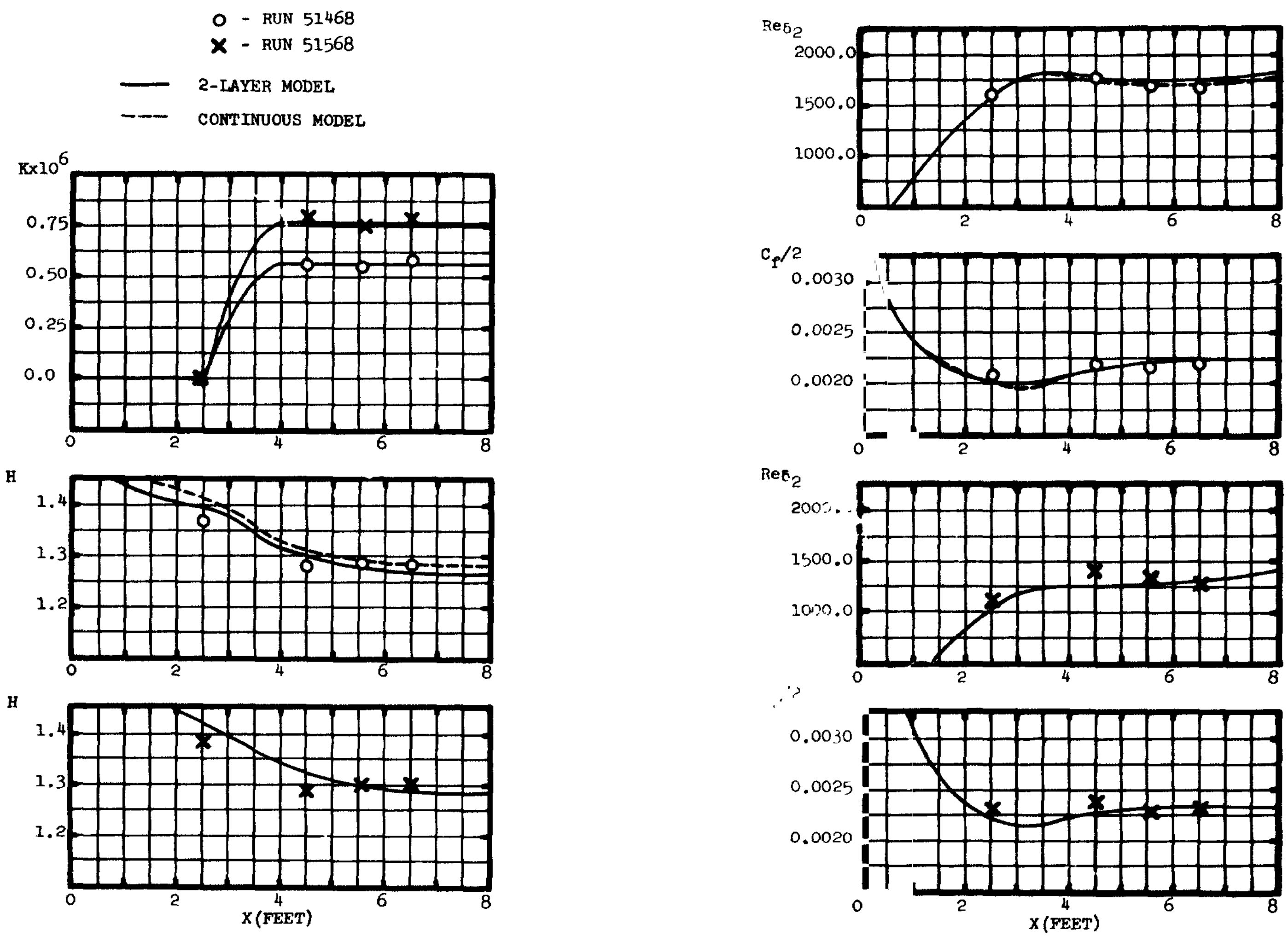

Figure 45. Comparison of prediction with data: run 51468 and run 51568, F = 0.0

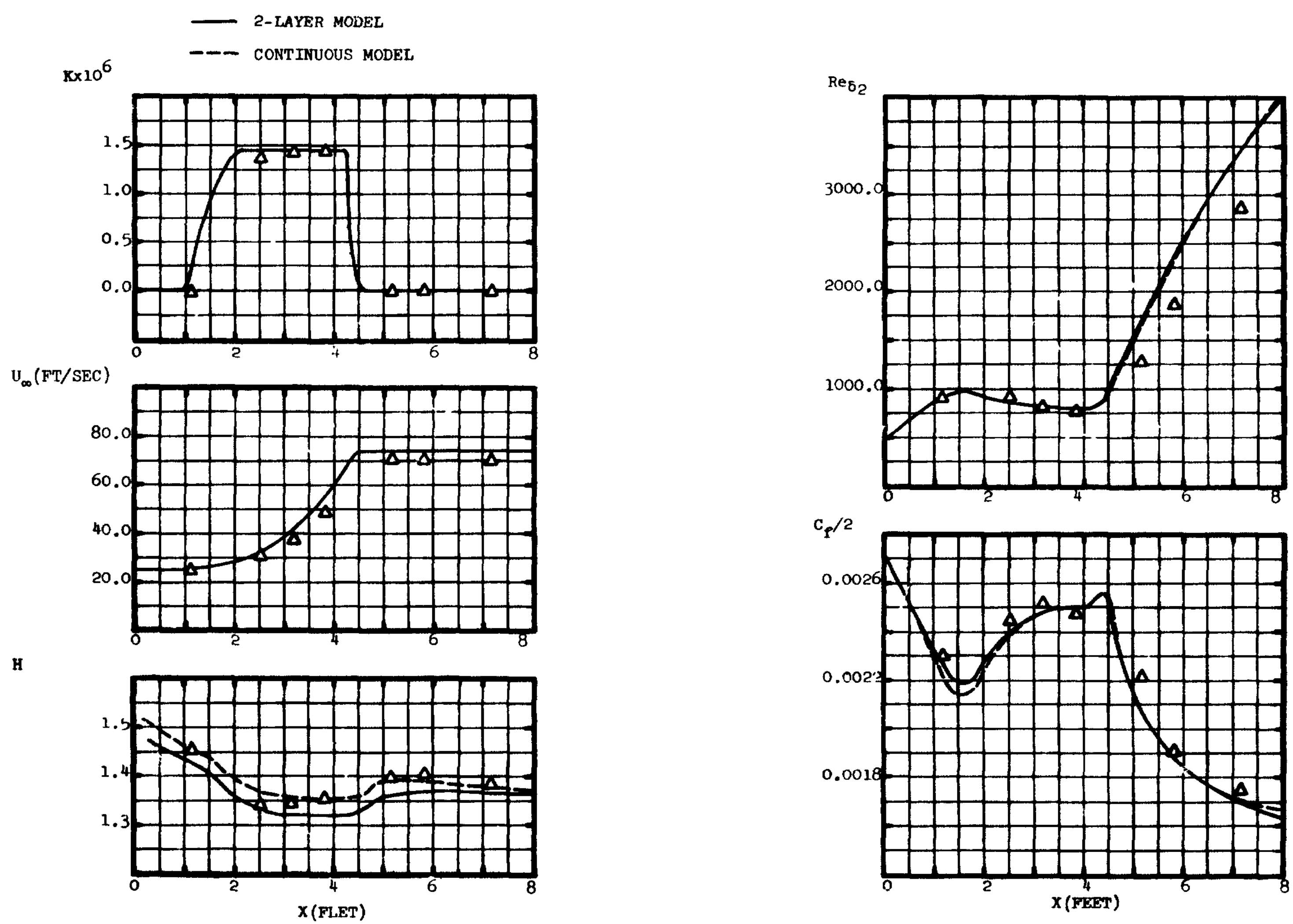

Figure 46. Comparison of prediction with data: run 73068, F = 0.0

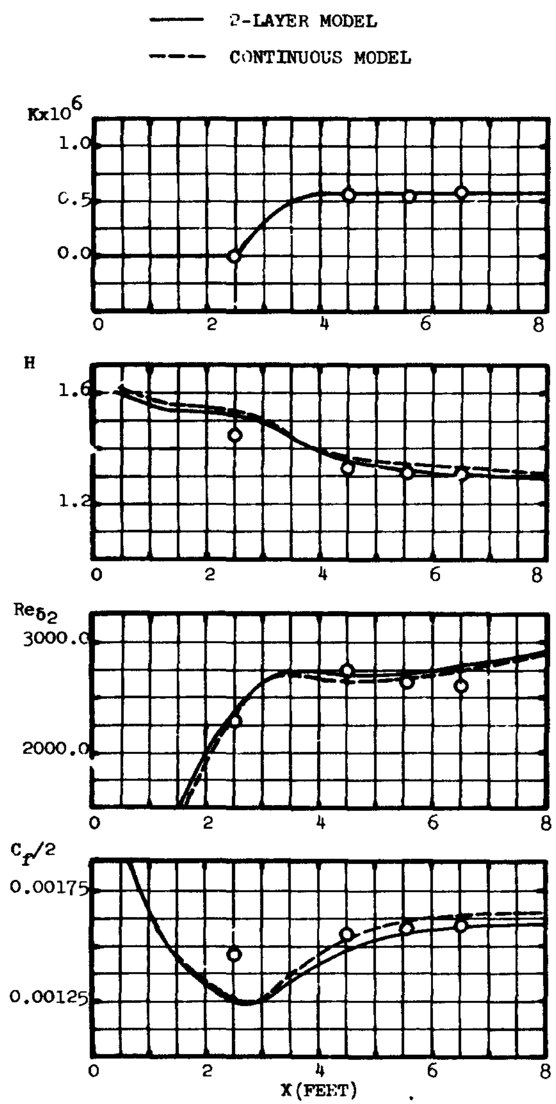

Figure 47. Comparison of prediction with data: run 42468, F = 0.002

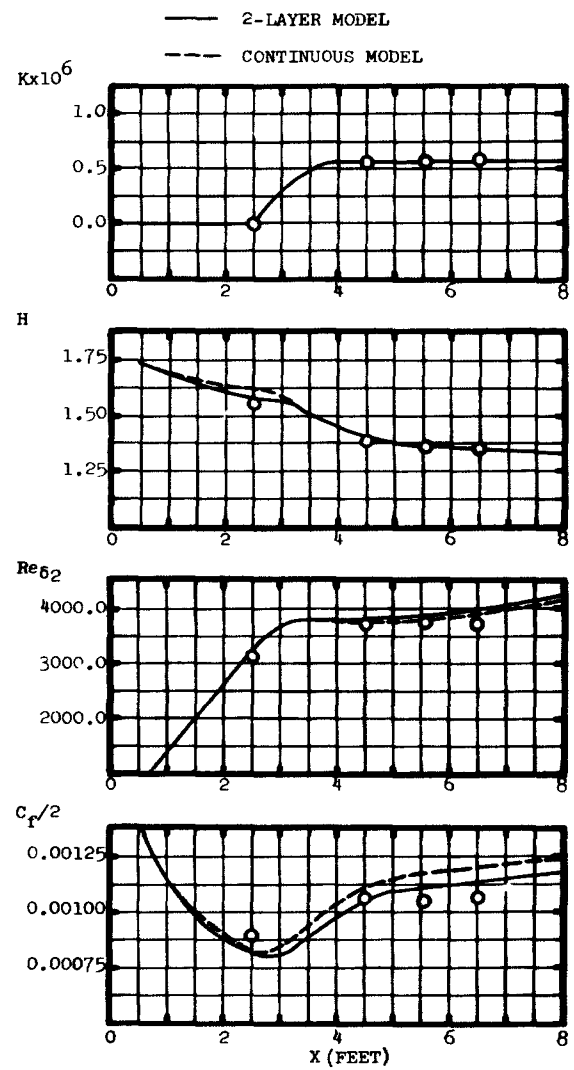

Figure 48. Comparison of prediction with data: run 41268, F = 0.004

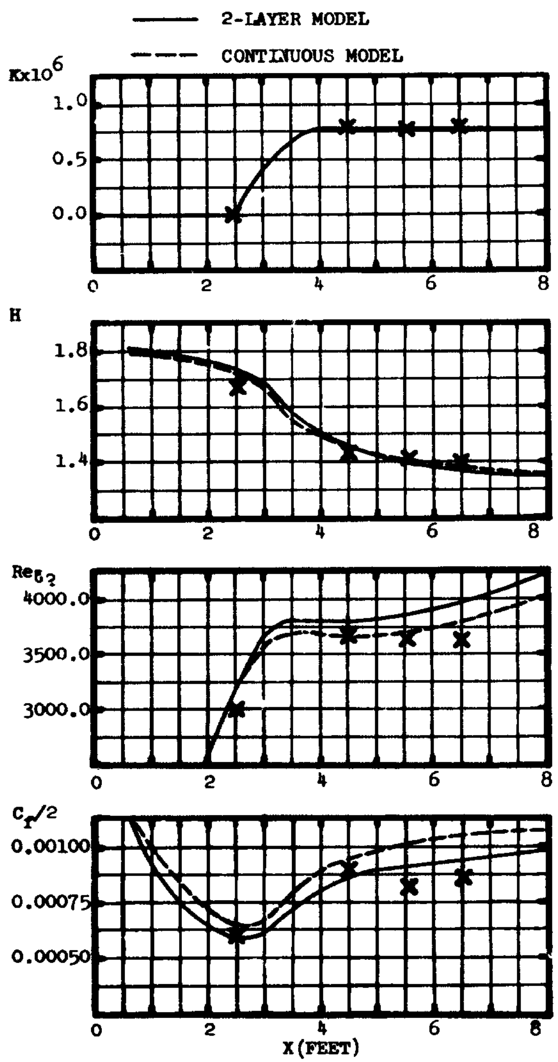

Figure 49. Comparison of prediction with data: run 120867, F = 0.006

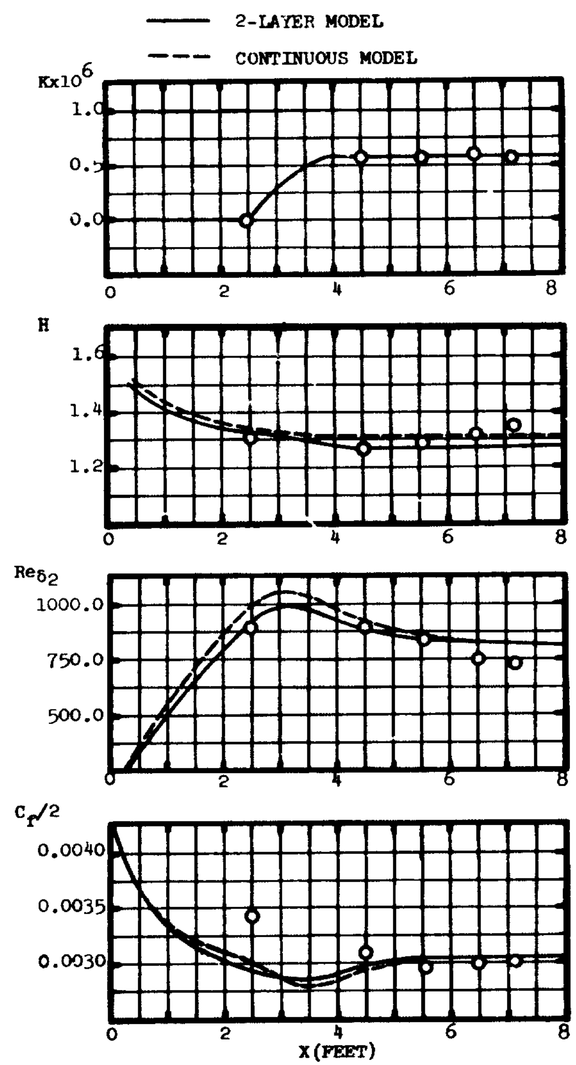

Figure 50. Comparison of prediction with data: run 52868, F = -0.002

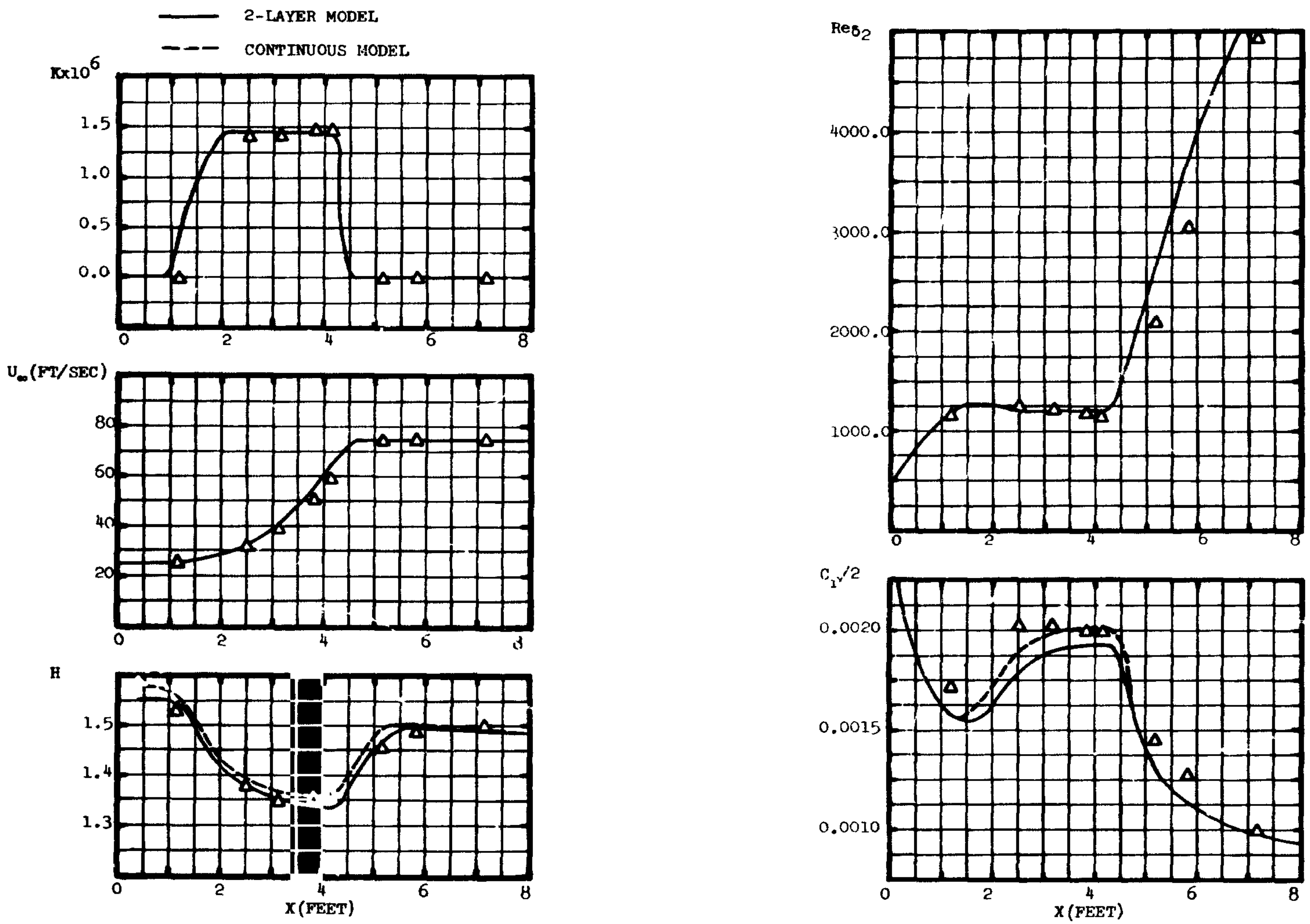

Figure 51. Comparison of prediction with data: run 81668, F = 0.002

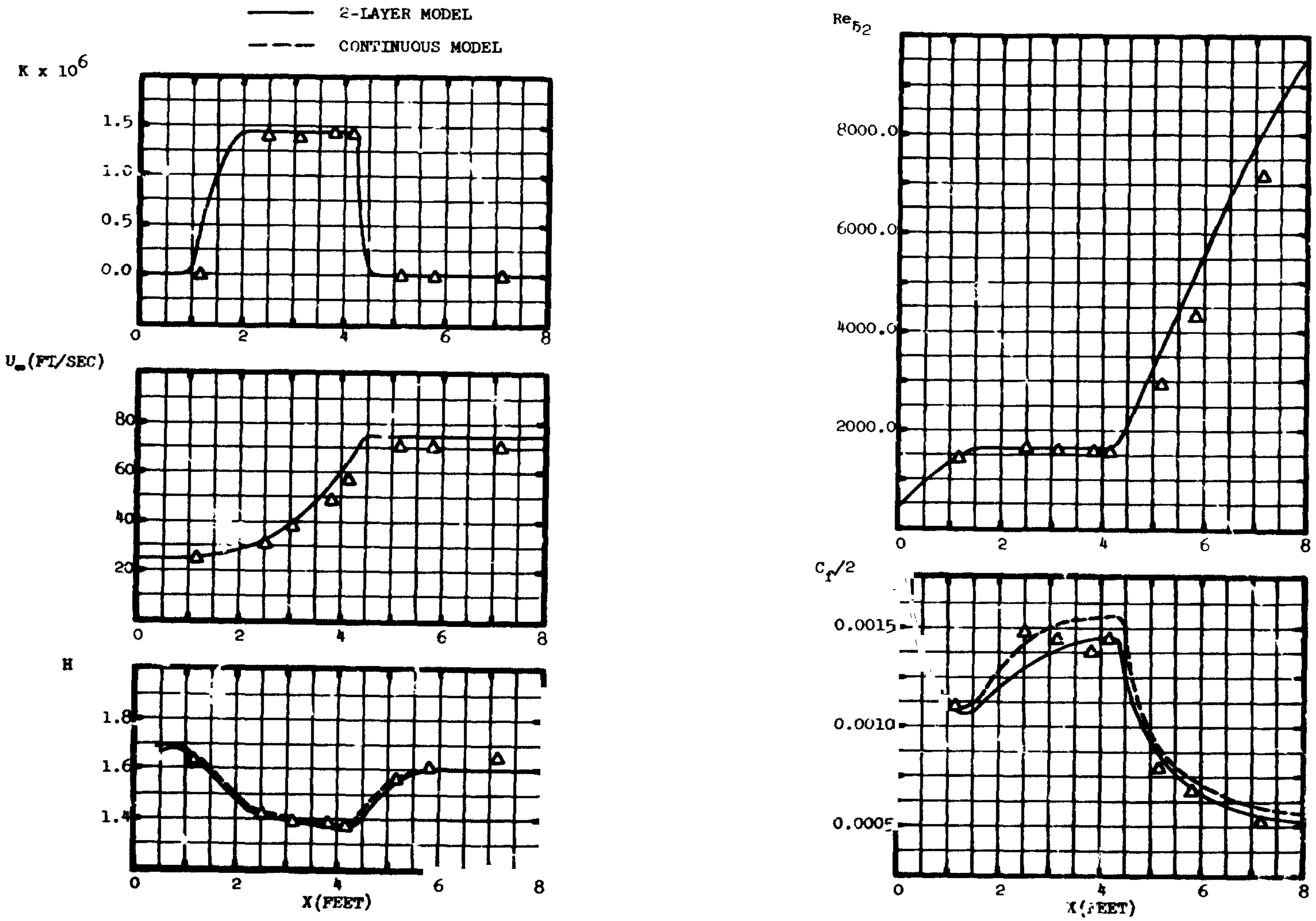

Figure 52. Comparison of prediction with data: run 82068, F = 0.004

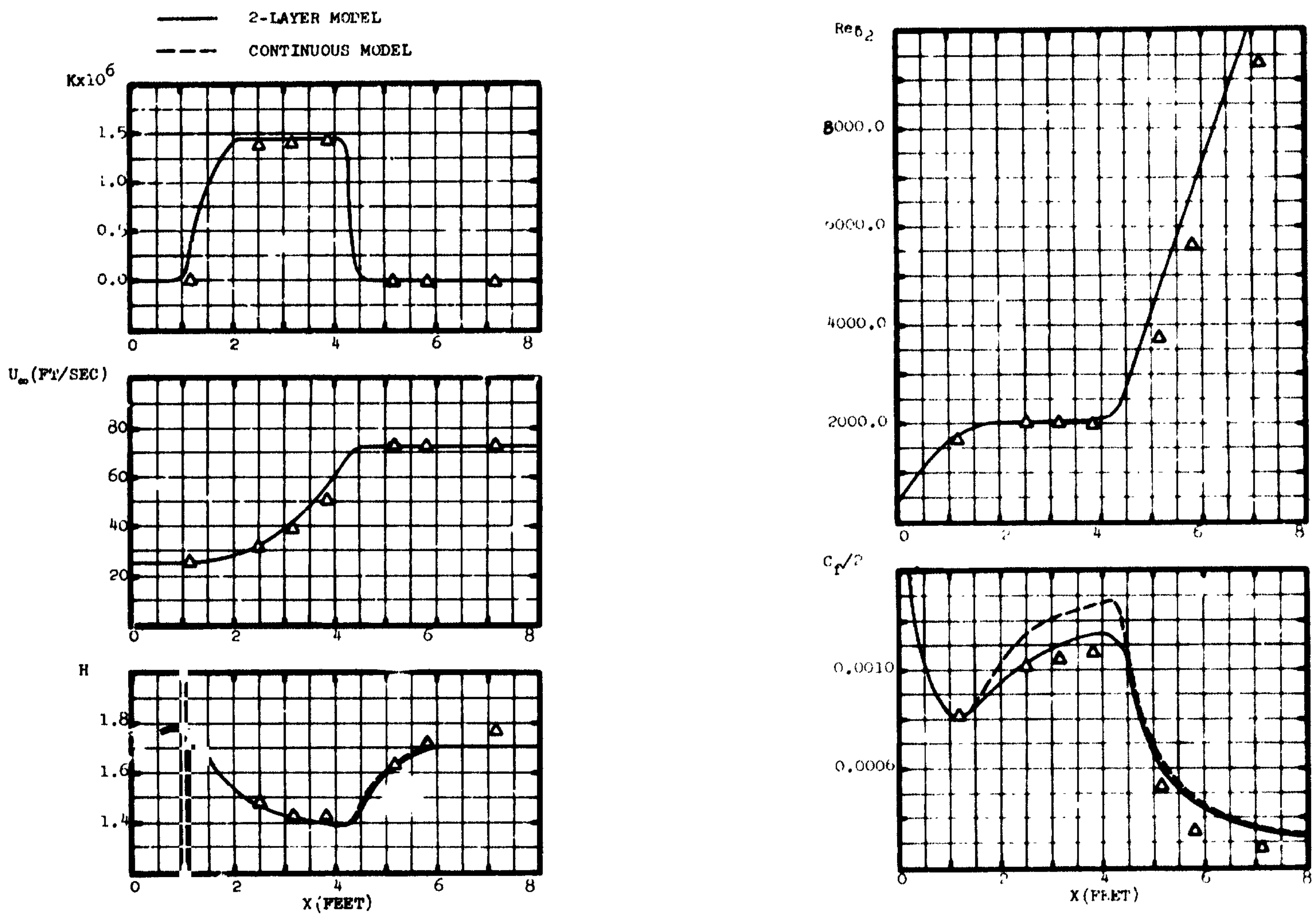

Figure 53. Comparison of prediction with data: run 82668 and run 8[illegible], F = [illegible]

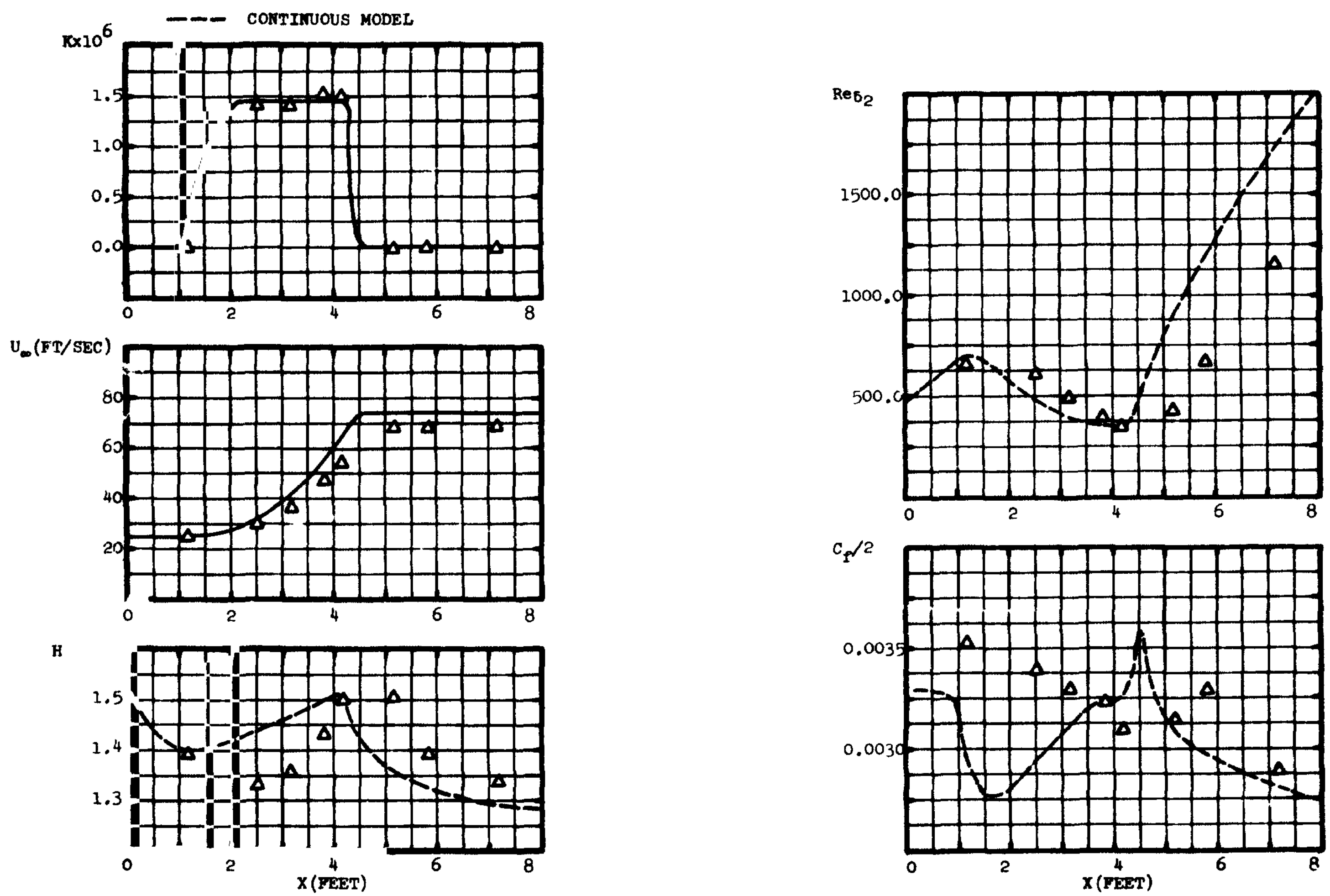

Figure 54. Comparison of prediction with data: run 80768, F = -0.002

CHAPTER VI

SUMMARY

One-hundred-twenty-six boundary layer mean velocity profiles from the Stanford Heat and Mass Transfer Apparatus are reported for accelerated flows with injection or suction at the wall. The pressure gradients investigated are those where $K = 0.57 \times 10^{-6}$, 0.77×10^{-6} , and 1.45×10^{-6} . For each pressure gradient, the boundary conditions investigated cover a range of constant blowing and sucking fractions from $F = -0.004$ to 0.006 .

These data serve as the basis for eddy-viscosity models which, combined with a finite-difference procedure, result in predictions of the data.

A. Conclusions

A.1. Experimental data

a) "Best estimates" of friction factors, based on the mean velocity profile data, are found to be self-consistent and in acceptable agreement with other experimental determinations, according to either the momentum integral method or the viscous sublayer model method. It is found that the present constant free-stream velocity friction factor data agrees with that of Simpson [17]. The effects of acceleration are found to be different in the cases of blowing and suction, but involves only small deviations from the following correlation of Simpson.

$$\frac{C_f}{2} = 0.0130 \left[\frac{\ell n|1+B|}{B}\right]^{0.7} (Re_{\delta_2})^{-1/4}$$

In suction, the friction factors decrease, whereas with blowing an increase is indicated.

b) In the impremeable wall cases, similar profiles in the inner regions of the layer were attained for all three values of the pressure gradient parameter K which were investigated. Two characteristics of the boundary layer are shown: (1) The profiles deviate from the flat plate "law of the wall" in an "overshot" manner within the logarithmic region, and (2) the wake region is substantially diminished. The degree of the profile "overshoot" in the logarithmic region and the associated decrease in the wake was found to be greater for progressively higher values of K. The extent of the logarithmic region, in U^+ vs y^+ coordinates, is also found to decrease as K increases.

These characteristics may be the result of surpressed turbulence in the region near the wall and a reduction of shear stress in the wake region, although turbulence measurements were not taken.

c) The qualitative characteristics of the inner regions for boundary layer flows in the presence of a strongly accelerated mainstream apply for the range of blowing and sucking fractions considered. The quantitative effects are, however, dependent upon blowing or sucking fraction. Similar-profiles are found to exist in the inner regions, except in flows where the structure of the layer appears to be substantially changed, i.e., where the layer may be relaminarizing. In the majority of the suction runs, non-similar behavior of this latter nature was observed.

d) In the outer regions of the boundary layer, similar profiles were attained for all blowing and sucking fractions considered, with the exception of the flows where the sucking fraction was F = -0.004. In this exceptional case, the profiles are found to continually adjust toward a seemingly laminar mode. It is noteworthy that similarity is also implied in "velocity-defect coordinates" as well as

U/U_∞ vs y/δ . This is a result of the friction factor being essentially constant in the flow direction.

This behavior in the outer regions coupled with a similar conclusion relating to the inner regions confirms the existence of completely similar profiles in asymptotic boundary layer flows with the exception of those cases noted.

e) The boundary layers reported here are believed to be turbulent. Unique values of Re_{δ_2} and shape factor H correspond to each set of K and F for asymptotic boundary layers. For asymptotic flows on an impermeable wall, both Re_{δ_2} and H are found to be in better agreement with those values predicted on the basis of an assumed turbulent 1/7-th power profile than with those for an exact laminar solution.

f) The shape factor correlation of Simpson over-predicts the experimental data and is, therefore, not considered applicable in such strong favorable pressure gradient flows.

g) Shear stress distributions were calculated for the present mean velocity profile data in the asymptotic and near-asymptotic flow regimes. It is found that the maximum shear stress occurs for values of y^+ less than 25 .

In asymptotic or near-asymptotic boundary layers, the shear stress distribution in the vicinity of the wall is found to be approximated by the dimensionless relation

$$\tau^+ = 1 + U^+ V_w^{\ +} + p^+ y^+ \left[1 - \frac{1}{y} \int_0^y \left(\frac{U}{U_\infty} \right)^2 dy \right] .$$

In the event $p^+ = 0$, this reduces to the shear stress distribution assumed in the formulation of Simpson's bi-logarithmic "law of the wall".

A.2. Theoretical prediction

a) Either of two simple Prandtl mixing length models formulated predict profiles in acceptable agreement with those experimentally obtained.

b) The proposed models, summarized in Appendix C, were used in a Patankar-Spalding prediction procedure. Predictions of H, Re_{δ_2}, and $C_f/2$ for the present data are found acceptable for most engineering purposes.

c) In term of an overall prediction, neither model appears superior to the other. The continuous modified Van Driest model is observed to yield the best estimates of shape factor H whereas the two-layer model yields the best estimates of friction factor.

B. Recommendations for Future Work

B.1. Experimental research

a) Execute a series of asymptotic runs at sufficiently high accelerations to include complete relaminarization.

b) Non-asymptotic flows should be investigated which include variable accelerations and wall boundary conditions to determine the restrictions on the results of the present study.

c) The decelerated boundary layer with blowing and suction should be investigated in order to complete the present study which was restricted to accelerated boundary layers.

d) Hot-wire anemometer studies of the fluctuation components of velocity should be undertaken, to study the structure of the layer resulting from these coupled effects of acceleration and transpiration. This investigation would also allow the generation of shear stress profiles with which to compare those generated in this work and that of Simpson [17].

e) Foreign gas injection poses no problem for the operation of the present apparatus. Suitable techniques are

available for sampling and measuring concentration profiles. Such data would materially aid in studying the relative effects of molecular and turbulent transport mechanisms.

B.2. Theoretical research

a) The present prediction model should be modified to handle highly non-asymptotic characteristics on the basis of data obtained in the proposed research investigations.

b) Utilizing the present prediction program, a systematic investigation of the influence of high velocity and large temperature difference should be undertaken.

c) Other existing prediction procedures should be combined with the required correlations of the present data, if possible, and resulting predictions of the present data should be obtained. Upon comparison of these results with the present predictions, the most appropriate model could be chosen.

Author's Note: The programs mentioned in items B.1. a,b,d and B.2. a,b are presently being pursued.

APPENDIX A

TABULATION OF EXPERIMENTAL DATA

The experimental data is presented in the following order according to blowing fraction:

I. Unblown flat plate runs

U_∞(ft/sec)	Date of run
42	31067
42	71967
86	72067
126	80867

II. Pressure gradient runs

		Date of run	
F	K = 0.57×10^{-6}	0.77×10^{-6}	1.45×10^{-6}
0.0	51468	51568	73068
0.001	51068	50768	81368
0.002	42468	42368	81568
0.004	41268	40268	82068
0.006	---	120867	82668,82268
-0.001	52068	52168	80568
-0.002	52868	52768	80768
-0.004	60168	60468	80968

For each blowing fraction, the experimental data is presented in the following order:

SUMMARY TABLE

This table contains the friction factors, integral parameters, blowing or sucking fractions, and conditions relevant to each profile. Uncertainty estimates for these quantities are presented for each run.

The enthalpy thickness discrepancies are also presented where the subscripts p and St refer to profile and Stanton number estimates, respectively.

SETUP DATA

Ambient conditions, free-stream velocity distributions, and $\dot{m}''$ distributions for each pressure gradient run are tabulated.

VELOCITY AND SHEAR PROFILES

Velocity and calculated shear stress profiles are tabulated.

DATE/NO. X STATIONS	$RE_x \times 10^{-5}$	RE_{δ_2}	H	WAKE STRENGTH, $\frac{\Delta U}{U_\tau}$	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$P_{BARO.}$, IN. HG.	$T_{AMBIENT}$, ^oF	RELATIVE HUMIDITY %	T_∞, ^oF
31067/4*	±0.25%	±1.9%	±0.025		±5%	±0.2		29.79	70.0	0.50	66.4
M = 1	1.31	627	1.443	0.4	2.76	2.94	2.76				
M = 2	6.56	1639	1.391	1.6	2.05	2.05	2.05				
M = 3	14.5	3177	1.361	2.4	1.76	1.84	1.76				
M = 4	19.9	4141	1.351	2.4	1.65	1.68	1.65				
71967/3	±0.25%	±1.9%	±0.04		±5%	±0.20		30.02	72.0	0.45	65.9
M = 1	3.25	947	1.416	1.2	2.28	2.48	2.28				
M = 2	6.81	1745	1.395	2.0	1.96	1.98	1.96				
M = 3	10.25	2366	1.377	2.4	1.79	2.03	1.79				
72067/3	±0.25%	±1.0%	±0.015		±5%			29.98	75.0	0.45	70.3
M = 1	7.97	1941	1.391	2.0	1.85	--	1.85				
M = 2	14.76	3250	1.380	2.4	1.59	--	1.59				
M = 3	21.65	4240	1.358	2.6	1.47	--	1.47				
80867/3	±0.25%	±1.0%	±0.01		±5%			29.82	74.8	0.45	68.0
M = 1	8.94	2137	1.416	2.2	2.00	--	2.00				
M = 2	19.06	4024	1.385	2.6	1.75	--	1.75				
M = 3	29.25	5720	1.358	2.5	1.63	--	1.63				

*NOTE: DATA OF SIMPSON [17]

DATE 71967 RUN NO. 1

M= 1 X= 45.70 IN. UG= 42.91 FT/SEC REDELTA2= 946.8

CF/2= 0.00228 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= [illegible] IN. DELTA2= [illegible] IN. H= 1.416

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0148	0.3369	6.33	7.06
0.0070	0.0173	0.3742	7.39	7.83
0.0080	0.0197	0.4097	8.44	8.57
0.0100	0.0247	0.4688	10.55	9.82
0.0130	0.0321	0.5247	13.72	10.99
0.0180	0.0444	0.5877	18.99	12.31
0.0230	0.0567	0.6217	24.26	13.01
0.0300	0.0740	0.6539	31.65	13.69
0.0400	0.0986	0.6819	42.20	14.27
0.0530	0.1307	0.7165	55.92	14.97
0.0780	0.1923	0.7518	82.29	15.74
0.1080	0.2662	0.7925	113.95	16.58
0.1430	0.3525	0.8326	150.87	17.43
0.1930	0.4758	0.8860	203.62	18.54
0.2430	0.5991	0.9286	255.38	19.43
0.2780	0.6853	0.9505	293.31	19.90
0.3180	0.7839	0.9675	335.51	20.25
0.3430	0.8456	0.9768	361.88	20.44
0.3930	0.9688	0.9885	414.64	20.69
0.4430	1.0921	0.9946	467.39	20.81
0.4930	1.2154	0.9976	520.14	20.88
0.5930	1.4619	1.0000	625.65	20.93

DATE 71967 RUN NO. 1

M= 2 X= 61.70 IN. UG= 43.29 FT/SEC REDELTA2= 1745.2

CF/2= 0.00196 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.697 IN. DELTA2= 0.0783 IN. H= 1.385

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0086	0.2712	5.92	6.13
0.0070	0.0100	0.3004	6.90	6.79
0.0080	0.0115	0.3410	7.89	7.70
0.0100	0.0143	0.4119	9.87	9.31
0.0120	0.0172	0.4582	11.83	10.35
0.0150	0.0215	0.4931	14.79	11.14
0.0190	0.0273	0.5336	18.74	12.06
0.0280	0.0402	0.5804	27.61	13.12
0.0480	0.0688	0.6369	47.33	14.39
0.0730	0.1047	0.6749	71.99	15.26
0.0980	0.1406	0.7033	96.63	15.90
0.1330	0.1908	0.7379	131.15	16.67
0.1980	0.2840	0.7884	195.23	17.82
0.2480	0.3557	0.8208	244.54	18.55
0.2980	0.4274	0.8527	293.85	19.27
0.3480	0.4991	0.8808	343.15	19.91
0.3980	0.5708	0.9047	392.45	20.45
0.4480	0.6425	0.9287	441.75	20.98
0.4980	0.7143	0.9476	491.06	21.41
0.5480	0.7860	0.9638	540.36	21.78
0.6080	0.8720	0.9772	599.52	22.08
0.6730	0.9652	0.9881	663.61	22.33
0.7480	1.0718	0.9941	737.56	22.46
0.8230	1.1804	0.9976	811.53	22.54
0.8980	1.2880	1.0000	885.48	22.59

DATE 71967 RUN NO. 1

M= 3 X= 77.50 IN. UG= 42.98 FT/SEC REDELTA2= 2365.6

CF/2= 0.00179 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.931 IN. DELTA2= 0.1272 IN. H= 1.377

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0064	0.2782	5.60	6.57
0.0070	0.0075	0.3033	6.54	7.17
0.0080	0.0086	0.3335	7.47	7.89
0.0090	0.0097	0.3512	8.40	8.30
0.0110	0.0118	0.4055	10.28	9.59
0.0130	0.0140	0.4399	12.14	10.40
0.0160	0.0172	0.4793	14.94	11.33
0.0200	0.0215	0.5134	18.68	12.13
0.0250	0.0268	0.5476	23.35	12.94
0.0310	0.0333	0.5693	28.95	13.45
0.0410	0.0440	0.6003	38.29	14.19
0.0510	0.0548	0.6201	47.63	14.65
0.0660	0.0709	0.6412	61.64	15.15
0.0860	0.0923	0.6616	80.31	15.63
0.1160	0.1245	0.6937	108.33	16.40
0.1510	0.1621	0.7160	141.02	16.92
0.2010	0.2158	0.7474	187.71	17.67
0.2510	0.2695	0.7776	234.41	18.37
0.3010	0.3232	0.8043	281.11	19.01
0.3610	0.3876	0.8302	337.14	19.62
0.4510	0.4842	0.8714	421.19	20.59
0.5360	0.5755	0.9014	500.57	21.31
0.6260	0.6721	0.9305	584.63	21.99
0.7260	0.7794	0.9574	678.01	22.63
0.8260	0.8868	0.9774	771.41	23.09
0.9260	0.9942	0.9897	864.79	23.38
1.0260	1.1015	0.9958	958.19	23.53
1.1260	1.2089	1.0000	1051.58	23.63

DATE 72067 RUN NO. 1

M= 1 X= 45.70 IN. UG= 86.23 FT/SEC REDELTA2= 1940.6

CF/2= 0.00185 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.424 IN. DELTA2= 0.0444 IN. H= 1.391

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0141	0.4105	11.26	9.55
0.0070	0.0165	0.4334	13.13	10.09
0.0090	0.0212	0.5024	16.88	11.69
0.0110	0.0259	0.5367	20.64	12.49
0.0140	0.0330	0.5805	26.27	13.51
0.0170	0.0401	0.5944	31.89	13.84
0.0230	0.0542	0.6231	43.15	14.50
0.0290	0.0684	0.6432	54.41	14.97
0.0370	0.0872	0.6658	69.42	15.49
0.0500	0.1179	0.6924	93.81	16.11
0.0650	0.1533	0.7244	121.95	16.86
0.0800	0.1886	0.7494	150.08	17.44
0.0950	0.2240	0.7724	178.23	17.97
0.1100	0.2594	0.7925	206.37	18.44
0.1250	0.2947	0.8124	234.51	18.90
0.1400	0.3301	0.8308	262.65	19.34
0.1550	0.3655	0.8456	290.80	19.68
0.1750	0.4126	0.8660	328.31	20.16
0.1950	0.4598	0.8860	365.84	20.62
0.2150	0.5069	0.9006	403.36	20.96
0.2400	0.5659	0.9208	450.26	21.43
0.2650	0.6248	0.9373	497.17	21.81
0.2900	0.6838	0.9505	544.07	22.12
0.3200	0.7545	0.9650	600.35	22.46
0.3500	0.8253	0.9743	656.64	22.67
0.3900	0.9196	0.9848	731.68	22.92
0.4300	1.0139	0.9909	806.72	23.06
0.4750	1.1200	0.9946	891.14	23.15
0.5250	1.2379	0.9973	984.95	23.21
0.5750	1.3558	0.9988	1078.75	23.24
0.6500	1.5326	0.9991	1219.47	23.25
0.7500	1.7684	1.0000	1407.08	23.27

DATE 72067 RUN NO. 1

N= 2 X= 61.53 IN. UG= 85.76 FT/SEC REDELTA2= 3230.4

CF/2= 0.00159 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS 0.000 PPLUS= 0.0000

DEL= 0.669 IN. DELTA2= 0.0740 IN. H= 1.380

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0090	0.3690	10.37	9.26
0.0070	0.0105	0.3999	12.11	10.05
0.0080	0.0120	0.4097	13.83	10.29
0.0090	0.0135	0.4208	15.57	10.57
0.0100	0.0150	0.4655	17.29	11.69
0.0120	0.0179	0.5009	20.75	12.58
0.0140	0.0209	0.5233	24.21	13.19
0.0160	0.0239	0.5408	27.67	13.57
0.0190	0.0284	0.5585	32.86	14.02
0.0230	0.0344	0.5768	39.78	14.49
0.0280	0.0419	0.5940	48.42	14.92
0.0350	0.0524	0.6112	60.53	15.35
0.0450	0.0673	0.6324	77.82	15.88
0.0600	0.0897	0.6570	103.75	16.50
0.0800	0.1197	0.6825	138.33	17.14
0.1000	0.1496	0.7080	172.93	17.78
0.1200	0.1795	0.7288	207.51	18.31
0.1450	0.2169	0.7525	250.73	18.89
0.1700	0.2543	0.7743	293.97	19.45
0.2000	0.2991	0.7987	345.84	20.06
0.2300	0.3440	0.8191	397.72	20.57
0.2600	0.3889	0.8379	449.59	21.05
0.2900	0.4338	0.8577	501.48	21.54
0.3300	0.4936	0.8802	570.64	22.10
0.3650	0.5459	0.8977	631.16	22.55
0.4050	0.6058	0.9189	700.33	23.08
0.4450	0.6656	0.9353	769.50	23.49
0.4900	0.7329	0.9546	847.32	23.97
0.5400	0.8077	0.9687	933.78	24.33
0.6000	0.8974	0.9812	1037.53	24.64
0.6700	1.0021	0.9902	1158.58	24.86
0.7500	1.1218	0.9966	1296.86	25.02
0.8300	1.2415	0.9988	1435.24	25.08
0.9300	1.3910	0.9997	1608.17	25.11
1.0300	1.5406	0.9998	1781.08	25.11
1.1800	1.7650	1.0000	2040.47	25.11

DATE 72067 RUN NO. 1

N= 3 X= 77.53 IN. UG= 85.46 FT/SEC REDELTA2= 4240.3

CF/2= 0.00147 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.877 IN. DELTA2= 0.0970 IN. H= 1.396

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0068	0.3568	9.98	9.31
0.0070	0.0080	0.3868	11.64	10.09
0.0080	0.0091	0.4370	13.31	11.39
0.0100	0.0114	0.4707	16.64	12.29
0.0130	0.0148	0.5288	21.63	13.76
0.0170	0.0194	0.5431	28.29	14.16
0.0210	0.0240	0.5587	34.94	14.57
0.0260	0.0297	0.5759	43.25	15.01
0.0330	0.0376	0.5958	54.90	15.53
0.0430	0.0490	0.6130	71.54	15.99
0.0580	0.0661	0.6385	96.49	16.66
0.0780	0.0890	0.6652	129.75	17.34
0.0980	0.1118	0.6891	163.02	17.96
0.1230	0.1403	0.7057	204.61	18.41
0.1530	0.1745	0.7314	254.52	19.07
0.1830	0.2087	0.7528	304.43	19.63
0.2180	0.2486	0.7752	362.64	20.22
0.2530	0.2886	0.7959	420.88	20.76
0.2930	0.3342	0.8166	487.42	21.29
0.3330	0.3798	0.8371	553.95	21.83
0.3730	0.4254	0.8548	620.50	22.29
0.4180	0.4768	0.8739	695.35	22.78
0.4780	0.5452	0.9002	795.17	23.47
0.5430	0.6193	0.9230	903.31	24.07
0.6130	0.6992	0.9427	1019.75	24.58
0.6830	0.7790	0.9618	1136.20	25.05
0.7530	0.8588	0.9755	1252.65	25.44
0.8230	0.9387	0.9843	1369.09	25.66
0.9130	1.0413	0.9939	1518.81	25.91
1.0430	1.1896	0.9988	1735.06	26.04
1.2930	1.4747	1.0000	2150.95	26.08

DATE 83067 RUN NO. 1

N= 1 X= 45.70 IN. UG= 126.64 FT/SEC REDELTA2= 2136.6

CF/2= 0.00200 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.303 IN. DELTA2= 0.0332 IN. H= 1.416

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0198	0.4705	17.25	10.52
0.0070	0.0231	0.4978	20.13	11.13
0.0080	0.0264	0.5201	23.00	11.63
0.0090	0.0297	0.5463	25.88	12.22
0.0100	0.0330	0.5712	28.74	12.77
0.0130	0.0429	0.5966	37.37	13.34
0.0160	0.0528	0.6124	45.99	13.69
0.0210	0.0694	0.6331	60.37	14.15
0.0260	0.0859	0.6503	74.74	14.54
0.0340	0.1123	0.6776	97.73	15.15
0.0450	0.1486	0.7073	129.36	15.82
0.0550	0.1817	0.7294	158.10	16.31
0.0650	0.2147	0.7491	186.84	16.75
0.0750	0.2477	0.7596	215.59	17.01
0.0850	0.2808	0.7858	244.33	17.57
0.0950	0.3138	0.8055	273.08	18.01
0.1050	0.3468	0.8224	301.82	18.39
0.1150	0.3799	0.8364	330.57	18.70
0.1250	0.4129	0.8517	359.31	19.04
0.1350	0.4459	0.8654	388.05	19.34
0.1450	0.4789	0.8787	416.80	19.64
0.1650	0.5450	0.9040	474.29	20.21
0.1850	0.6111	0.9257	531.78	20.68
0.2050	0.6771	0.9444	589.26	21.11
0.2250	0.7432	0.9610	646.75	21.49
0.2450	0.8092	0.9708	704.24	21.70
0.2650	0.8753	0.9802	761.73	21.92
0.2950	0.9744	0.9889	847.97	22.11
0.3250	1.0735	0.9933	934.21	22.20
0.3700	1.2221	0.9965	1063.55	22.28
0.4450	1.4699	0.9989	1279.14	22.33
0.4950	1.6350	0.9999	1422.86	22.35
0.5450	1.8002	1.0000	1566.59	22.36

DATE 83067 RUN NO. 1

N= 2 X= 61.50 IN. UG= 126.64 FT/SEC REDELTA2= 4023.8

CF/2= 0.00175 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.543 IN. DELTA2= 0.0626 IN. H= 1.385

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0111	0.4317	16.12	10.32
0.0070	0.0129	0.4429	18.81	10.59
0.0080	0.0147	0.4646	21.50	11.11
0.0090	0.0166	0.4881	24.19	11.67
0.0110	0.0203	0.5198	29.56	12.42
0.0140	0.0258	0.5522	37.64	13.20
0.0170	0.0313	0.5682	45.70	13.58
0.0200	0.0369	0.5804	53.76	13.89
0.0240	0.0442	0.5949	64.51	14.22
0.0320	0.0590	0.6190	86.01	14.80
0.0420	0.0774	0.6390	112.90	15.28
0.0520	0.0958	0.6585	139.78	15.74
0.0620	0.1143	0.6759	166.66	16.16
0.0720	0.1327	0.6903	193.54	16.50
0.1020	0.1880	0.7265	274.17	17.37
0.1270	0.2341	0.7550	341.38	18.06
0.1570	0.2894	0.7834	422.01	18.73
0.1920	0.3539	0.8155	516.10	19.50
0.2320	0.4276	0.8479	623.62	20.27
0.2620	0.4829	0.8683	704.26	20.76
0.2920	0.5382	0.8889	784.90	21.26
0.3220	0.5935	0.9070	865.54	21.69
0.3520	0.6488	0.9253	946.19	22.12
0.3820	0.7041	0.9409	1026.82	22.48
0.4120	0.7594	0.9537	1107.46	22.80
0.4420	0.8146	0.9656	1188.13	23.09
0.4700	0.8659	0.9747	1263.75	23.30
0.5170	0.9529	0.9866	1389.70	23.59
0.5670	1.0450	0.9933	1524.10	23.74
0.6170	1.1372	0.9962	1658.51	23.83
0.6670	1.2293	0.9990	1792.91	23.89
0.7170	1.3215	0.9995	1927.31	23.90
0.7670	1.4136	1.0000	2061.71	23.91

DATE 80867 RUN NO. 1

M= 3 X= 77.50 IN. UG= 126.25 FT/SEC REDELTA2= 5720.3

CF/2= 0.00163 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.791 IN. DELTA2= 0.0893 IN. H= 1.358

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0076	0.4131	15.55	10.21
0.0070	0.0088	0.4531	18.14	11.20
0.0080	0.0101	0.4838	20.74	11.96
0.0090	0.0114	0.5027	23.33	12.42
0.0100	0.0126	0.5044	25.92	12.47
0.0120	0.0152	0.5230	31.10	12.93
0.0140	0.0177	0.5353	36.29	13.23
0.0180	0.0227	0.5565	46.65	13.76
0.0240	0.0303	0.5769	62.21	14.26
0.0310	0.0392	0.5949	80.36	14.71
0.0430	0.0543	0.6204	111.46	15.34
0.0580	0.0733	0.6425	150.34	15.88
0.0730	0.0922	0.6662	189.22	16.47
0.0930	0.1175	0.6883	241.07	17.01
0.1130	0.1428	0.7075	292.91	17.48
0.1330	0.1680	0.7242	344.75	17.90
0.1530	0.1933	0.7418	396.60	18.34
0.1730	0.2186	0.7562	448.44	18.69
0.1980	0.2502	0.7721	513.24	19.08
0.2230	0.2818	0.7884	578.05	19.49
0.2480	0.3133	0.8038	642.84	19.87
0.2730	0.3449	0.8182	707.66	20.22
0.3030	0.3828	0.8334	785.41	20.60
0.3330	0.4207	0.8503	863.18	21.02
0.3780	0.4776	0.8718	979.83	21.55
0.4280	0.5408	0.8940	1109.44	22.09
0.4780	0.6040	0.9155	1239.03	22.63
0.5280	0.6671	0.9350	1368.64	23.11
0.5780	0.7303	0.9507	1498.25	23.50
0.6280	0.7935	0.9638	1627.86	23.82
0.7030	0.8882	0.9785	1822.27	24.18
0.8030	1.0146	0.9915	2081.48	24.51
0.9030	1.1409	0.9973	2340.70	24.65
1.0530	1.3305	1.0000	2729.51	24.72

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	F x 10^3	K x 10^6	RE_{δ_2}	H	$K(H+1)RE_{\delta_2}-F$	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ LOGARITHMIC REGION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
51468/4	±0.02	±0.10		±8%	±2.3%	±0.04	±0.15	±0.25		±0.15		±8.0
M = 1	29.90	41.14	0.0	0.0	1606	1.370	--	--	2.10	2.15	2.10	6.8
M = 2	53.86	50.94	0.0	0.568	1776	1.282	2.30	2.09	--	2.20	2.20	1.1
M = 3	66.83	62.65	0.0	0.552	1692	1.288	2.14	2.09	--	2.01	2.16	5.7
M = 4	77.79	78.16	0.0	0.586	1674	1.283	2.24	2.19	--	1.92	2.19	5.5
51568/4	±0.02	±0.12		±13%	±4.0%	±0.07	±0.35	±0.45		±0.20		±7.0
M = 1	29.90	30.30	0.0	0.0	1115	1.384	--	--	2.31	2.52	2.31	19.5
M = 2	53.86	37.52	0.0	0.794	1410	1.288	2.56	2.35	--	2.62	2.38	0.0
M = 3	66.83	46.06	0.0	0.758	1350	1.301	2.35	2.14	--	2.17	2.28	1.7
M = 4	77.79	57.34	0.0	0.788	1283	1.301	2.33	2.07	--	2.21	2.33	-3.4
73068/7	±0.02	±0.10		±10%	±5.0%	±0.08	±0.35	±0.50		±0.20		±7.0
M = 1	13.78	25.25	0.0	0.0	913	1.455	--	--	2.26	2.70	2.30	-8.0
M = 2	29.67	31.09	0.0	1.38	944	1.342	3.06	2.23	--	2.72	2.45	-1.7
M = 3	37.69	37.76	0.0	1.44	825	1.344	2.78	2.52	--	2.51	2.52	-1.5
M = 4	45.64	48.70	0.0	1.45	775	1.355	2.64	2.32	--	2.42	2.48	-2.1
M = 5	61.77	70.73	0.0	0.0	1289	1.399	--	--	2.22	1.84	2.22	1.4
M = 6	69.70	70.93	0.0	0.0	1866	1.406	--	--	1.94	1.58	1.91	2.0
M = 7	85.78	71.20	0.0	0.0	2866	1.385	--	--	1.75	1.50	1.75	1.6

SETUP DATA

VWALL/UG= 0.000

RUN:	51468-1	51568-1	[illegible]668-1
PBARC (IN. HG) =	30.05	29.99	29.83
TAMBIENT (DEG-F) =	72.0	73.2	76.8
RELATIVE HUMIDITY =	0.45	0.45	0.45
TGAS (DEG-F) =	68.99	69.09	66.89
GAS DENSITY (LBM/FT3) =	0.0753	0.0749	0.0746
GAS VISCOSITY (FT2/SEC) =	0.162E-03	0.163E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	41.46	0.00000	30.47	0.00000	25.38	0.00000
3.953	41.46		30.47		25.38	
5.953	41.46	0.00000	30.47	0.00000	25.38	0.00000
7.961	41.41		30.44		25.34	
9.969	41.38	0.00000	30.40	0.00000	25.29	0.00000
11.953	41.45		30.40		25.25	
13.937	41.35	0.00000	30.47	0.00000	25.25	0.00000
15.945	41.33		30.40		25.28	
17.953	41.26	0.00000	30.40	0.00000	25.43	0.00000
19.922	41.22		30.33		25.86	
21.938	41.11	0.00000	30.33	0.00000	26.39	0.00000
23.954	41.16		30.25		27.29	
25.962	41.14	0.00000	30.30	0.00000	28.25	0.00000
27.962	41.14		30.30		29.53	
29.978	41.14	0.00000	30.30	0.00000	30.73	0.00000
31.939	41.19		30.33		32.18	
33.955	41.35	0.00000	30.47	0.00000	33.97	0.00000
35.955	41.57		30.62		35.83	
37.971	41.99	0.00000	31.02	0.00000	37.78	0.00000
39.987	42.75		31.44		40.05	
41.963	43.52	0.00000	32.01	0.00000	42.50	0.00000
43.963	44.53		32.73		45.39	
45.963	45.61	0.00000	33.54	0.00000	48.76	0.00000
47.979	46.86		34.49		52.40	
49.979	48.19	0.00000	35.38	0.00000	56.93	0.00000
51.979	49.60		36.47		62.25	
53.995	51.05	0.00000	37.58	0.00000	67.99	0.00000
55.971	52.63		38.75		69.75	
57.971	54.30	0.00000	39.89	0.00000	69.72	0.00000
59.955	55.99		41.16		69.71	
61.979	57.88	0.00000	42.57	0.00000	69.64	0.00000
63.971	59.77		43.96		69.64	
65.979	61.85	0.00000	45.51	0.00000	69.64	0.00000
67.963	64.09		47.15		69.71	
69.971	66.51	0.00000	48.96	0.00000	69.71	0.00000
71.979	69.16		50.84		69.67	
73.963	72.03	0.00000	52.95	0.00000	69.74	0.00000
75.939	75.06		55.14		69.69	
77.947	78.61	0.00000	57.77	0.00000	69.74	0.00000
79.939	82.51		60.52		69.78	
81.931	86.86	0.00000	63.70	0.00000	69.93	0.00000
83.962	91.46		67.09		69.99	
85.931	96.43	0.00000	70.72	0.00000	69.98	0.00000
87.915	101.88		74.75		69.99	
89.939	108.12	0.00000	79.24	0.00000	69.98	0.00000
91.931	114.97		84.21		70.03	
93.947	122.55	0.00000	89.82	0.00000	70.06	0.00000

DATE 51468 RUN NO. 1

X= 1 X= 29.90 IN. UG= 41.14 FT/SEC REDELTA2= 1625.7

CF/2= 0.00210 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.739 IN. DELTA2= 0.0759 IN. H= 1.370

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0073	0.0095	0.3258	6.79	7.10
0.0080	0.0108	0.3545	7.76	7.74
0.0090	0.0122	0.3863	8.72	8.42
0.0100	0.0135	0.4172	9.70	9.10
0.0110	0.0149	0.4371	10.67	9.54
0.0120	0.0162	0.4591	11.64	10.27
0.0140	0.0189	0.4881	13.58	10.64
0.0160	0.0216	0.5155	15.51	11.25
0.0180	0.0244	0.5351	17.46	11.76
0.0200	0.0271	0.5581	19.39	12.18
0.0230	0.0311	0.5806	22.31	12.65
0.0270	0.0365	0.5989	26.18	13.07
0.0320	0.0433	0.6129	31.03	13.38
0.0400	0.0541	0.6370	38.79	13.90
0.0480	0.0649	0.6522	46.55	14.23
0.0580	0.0785	0.6700	56.25	14.62
0.0700	0.0947	0.6883	67.88	15.02
0.0830	0.1123	0.7043	80.50	15.36
0.1030	0.1394	0.7254	99.89	15.82
0.1230	0.1664	0.7441	119.28	16.23
0.1480	0.2002	0.7649	143.53	16.69
0.1780	0.2408	0.7918	172.63	17.28
0.2080	0.2814	0.8106	201.72	17.69
0.2430	0.3288	0.8376	235.66	18.28
0.2780	0.3761	0.8546	269.61	18.65
0.3180	0.4302	0.8758	308.39	19.11
0.3580	0.4843	0.8913	347.19	19.45
0.4080	0.5520	0.9176	395.68	20.02
0.4580	0.6196	0.9344	444.17	20.39
0.5080	0.6873	0.9524	492.66	20.78
0.5580	0.7549	0.9647	541.15	21.05
0.6330	0.8564	0.9795	613.89	21.37
0.7080	0.9579	0.9862	686.62	21.51
0.7830	1.0593	0.9954	759.35	21.72
0.8580	1.1608	0.9980	832.09	21.78
0.9330	1.2623	0.9987	904.83	21.79
1.0080	1.3638	1.0000	977.56	21.82

DATE 51468 RUN NO. 1

X= 2 X= 53.96 IN. UG= 56.96 FT/SEC REDELTA2= 1776.4

CF/2= 0.00223 VWALL/UG= 0.00000 K= 0.564E-06

VWALLPLUS= 0.0000 PPLUS= -0.00550

DEL= 0.826 IN. DELTA2= 0.0674 IN. H= 1.282

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0073	0.3454	7.37	7.36
0.0070	0.0085	0.3696	8.60	7.87
0.0080	0.0097	0.4272	9.83	9.10
0.0090	0.0109	0.4637	11.06	9.88
0.0100	0.0121	0.4957	12.29	10.56
0.0110	0.0133	0.5226	13.52	11.13
0.0120	0.0145	0.5387	14.75	11.47
0.0130	0.0157	0.5535	15.98	11.78
0.0150	0.0182	0.5828	18.44	12.42
0.0170	0.0206	0.6030	20.89	12.85
0.0200	0.0242	0.6266	24.58	13.35
0.0240	0.0290	0.6514	29.50	13.87
0.0290	0.0351	0.6739	35.65	14.36
0.0350	0.0424	0.6927	43.02	14.76
0.0420	0.0508	0.7103	51.62	15.14
0.0500	0.0605	0.7270	61.45	15.49
0.0590	0.0714	0.7419	72.51	15.78
0.0690	0.0835	0.7575	84.81	16.13
0.0790	0.0956	0.7698	97.10	16.40
0.0940	0.1138	0.7841	115.53	16.71
0.1090	0.1319	0.8013	133.96	17.07
0.1290	0.1561	0.8177	158.56	17.42
0.1490	0.1804	0.8316	183.14	17.72
0.1740	0.2106	0.8459	213.86	18.02
0.2040	0.2469	0.8624	250.74	18.37
0.2390	0.2893	0.8767	293.76	18.67
0.2790	0.3377	0.8902	342.93	18.97
0.3290	0.3982	0.9073	404.38	19.33
0.3890	0.4708	0.9222	478.12	19.65
0.4690	0.5677	0.9415	576.45	20.06
0.5690	0.6887	0.9621	699.37	20.49
0.6690	0.8098	0.9756	822.28	20.79
0.7690	0.9308	0.9858	945.20	21.00
0.8690	1.0518	0.9931	1068.10	21.16
0.9690	1.1729	0.9961	1191.01	21.22
1.0690	1.2939	0.9987	1313.93	21.28
1.1690	1.4150	1.0000	1436.34	21.32

DATE 51468 RUN NO. 1

X= 3 X= 66.83 IN. UG= 62.65 FT/SEC REDELTA2= 1692.0

CF/2= 0.00216 VWALL/UG= 0.00000 K= 0.552E-06

VWALLPLUS= 0.0000 PPLUS= -0.00550

DEL= 0.691 IN. DELTA2= 0.0526 IN. H= 1.288

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0087	0.3896	8.98	8.38	0.954
0.0070	0.0101	0.4230	10.47	9.10	0.948
0.0080	0.0116	0.4619	11.97	9.94	0.941
0.0090	0.0130	0.4887	13.46	10.51	0.935
0.0100	0.0145	0.5292	14.97	11.39	0.929
0.0110	0.0159	0.5583	16.46	12.01	0.923
0.0120	0.0174	0.5777	17.96	12.43	0.917
0.0130	0.0188	0.5908	19.45	12.71	0.912
0.0150	0.0217	0.6165	22.44	13.26	0.901
0.0170	0.0246	0.6359	25.44	13.68	0.892
0.0200	0.0290	0.6608	29.92	14.21	0.877
0.0230	0.0333	0.6739	34.41	14.50	0.864
0.0270	0.0391	0.6904	40.39	14.85	0.846
0.0330	0.0478	0.7106	49.37	15.29	0.821
0.0400	0.0579	0.7263	59.84	15.62	0.793
0.0480	0.0695	0.7425	71.81	15.98	0.763
0.0580	0.0840	0.7613	86.78	16.38	0.728
0.0730	0.1057	0.7854	109.22	16.90	0.678
0.0880	0.1274	0.8028	131.65	17.27	0.633
0.1030	0.1491	0.8189	154.09	17.61	0.591
0.1230	0.1781	0.8390	184.02	18.02	0.540
0.1430	0.2071	0.8560	213.94	18.41	0.494
0.1630	0.2360	0.8691	243.86	18.70	0.453
0.1880	0.2722	0.8846	281.26	19.03	0.406
0.2230	0.3229	0.9016	333.63	19.39	0.349
0.2630	0.3808	0.9184	393.47	19.76	0.293
0.3130	0.4532	0.9328	468.28	20.07	0.236
0.3630	0.5256	0.9478	543.09	20.39	0.190
0.4380	0.6342	0.9608	655.29	20.67	0.136
0.5130	0.7428	0.9728	767.50	20.93	0.098
0.5880	0.8514	0.9797	879.70	21.08	0.077
0.6630	0.9600	0.9886	991.91	21.27	0.052
0.7380	1.0686	0.9923	1104.12	21.35	0.041
0.8130	1.1772	0.9958	1216.33	21.42	0.035
0.8880	1.2858	0.9975	1328.54	21.46	0.031
0.9630	1.3944	0.9992	1440.74	21.50	0.030
1.0380	1.5030	1.0000	1552.95	21.52	0.029

DATE 51468 RUN NO. 1

X= 4 X= 77.79 IN. UG= 78.16 FT/SEC REDELTA2= 1673.7

CF/2= 0.00219 VWALL/UG= 0.00000 K= 0.586E-06

VWALLPLUS= 0.0000 PPLUS= -0.00571

DEL= 0.588 IN. DELTA2= 0.0417 IN. H= 1.293

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0102	0.4553	11.27	9.73	0.947
0.0070	0.0119	0.5052	13.15	10.78	0.934
0.0080	0.0136	0.5467	15.02	11.67	0.926
0.0090	0.0153	0.5752	16.90	12.28	0.919
0.0100	0.0170	0.5941	18.78	12.70	0.912
0.0110	0.0187	0.6137	20.65	13.11	0.906
0.0120	0.0204	0.6283	22.54	13.41	0.899
0.0130	0.0221	0.6421	24.42	13.71	0.893
0.0140	0.0238	0.6510	26.29	13.91	0.886
0.0150	0.0255	0.6599	28.17	14.10	0.880
0.0170	0.0289	0.6752	31.92	14.42	0.869
0.0190	0.0323	0.6869	35.68	14.67	0.857
0.0210	0.0357	0.6969	39.44	14.89	0.846
0.0230	0.0391	0.7042	43.19	15.04	0.835
0.0250	0.0425	0.7134	46.95	15.23	0.824
0.0270	0.0459	0.7196	50.71	15.35	0.814
0.0300	0.0510	0.7320	56.34	15.63	0.799
0.0340	0.0578	0.7375	63.86	15.75	0.779
0.0380	0.0646	0.7482	71.36	15.99	0.762
0.0420	0.0714	0.7574	78.88	16.18	0.742
0.0470	0.0799	0.7679	88.27	16.39	0.719
0.0530	0.0902	0.7782	99.53	16.62	0.694
0.0600	0.1021	0.7917	112.68	16.91	0.665
0.0680	0.1157	0.8044	127.70	17.18	0.634
0.0780	0.1327	0.8183	146.49	17.47	0.599
0.0880	0.1497	0.8302	165.27	17.73	0.564
0.1000	0.1701	0.8450	187.81	18.04	0.526
0.1140	0.1939	0.8590	214.09	18.34	0.486
0.1290	[illegible]	0.8725	242.26	18.63	0.446
0.1440	0.2449	0.8836	270.43	18.87	0.410
0.1600	0.2722	0.8930	300.45	19.09	0.375
0.1770	0.3011	0.9048	332.41	19.32	0.341
0.1970	0.3351	0.9148	369.98	19.54	0.305
0.2170	0.3691	0.9239	407.53	19.73	0.272
0.2420	0.4116	0.9329	454.49	19.92	0.236
0.2720	0.4627	0.9445	510.83	20.17	0.199
0.3220	0.5477	0.9586	604.73	20.47	0.151
0.3720	0.6328	0.9677	698.53	20.66	0.113
0.4220	0.7178	0.9748	792.53	20.81	0.084
0.4870	0.8284	0.9830	914.61	21.00	0.057
0.5870	0.9985	0.9900	1102.41	21.14	0.031
0.6870	1.1686	0.9951	1290.22	21.25	0.016
0.7870	1.3387	0.9973	1478.01	21.31	0.009
0.8870	1.5088	0.9984	1665.82	21.32	0.004
0.9870	1.6789	0.9995	1853.63	21.34	0.003
1.0870	1.8489	1.0000	2041.43	21.35	0.002

DATE 51568 RUN NO. 1

N= 1 X= 29.90 IN. UG= 30.30 FT/SEC REDELTA2= 1115.3

CF/2= 0.00231 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.733 IN. DELTA2= 0.0720 IN. H= 1.384

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0096	0.2779	5.22	5.78
0.0080	0.0110	0.3071	5.96	6.38
0.0090	0.0123	0.3226	6.71	6.71
0.0110	0.0151	0.3815	8.20	7.93
0.0130	0.0178	0.4239	9.68	8.81
0.0150	0.0205	0.4545	11.17	9.45
0.0180	0.0246	0.5024	13.41	10.44
0.0210	0.0288	0.5374	15.65	11.17
0.0240	0.0329	0.5530	17.88	11.50
0.0280	0.0383	0.5850	20.86	12.16
0.0330	0.0452	0.6153	24.58	12.79
0.0390	0.0534	0.6309	29.05	13.12
0.0460	0.0630	0.6573	34.26	13.66
0.0540	0.0739	0.6683	40.23	13.90
0.0640	0.0876	0.6880	47.68	14.31
0.0760	0.1041	0.7037	56.62	14.63
0.0890	0.1219	0.7241	66.29	15.05
0.1090	0.1493	0.7406	81.20	15.40
0.1340	0.1835	0.7648	99.82	15.90
0.1590	0.2177	0.7867	118.45	16.36
0.1940	0.2657	0.8185	144.51	17.01
0.2340	0.3204	0.8447	174.31	17.56
0.2840	0.3889	0.8702	211.56	18.09
0.3340	0.4574	0.8936	248.80	18.58
0.3840	0.5258	0.9124	286.05	18.97
0.4340	0.5943	0.9335	323.29	19.40
0.5090	0.6970	0.9604	379.16	19.97
0.5840	0.7997	0.9754	435.03	20.28
0.6590	0.9024	0.9853	490.90	20.49
0.7340	1.0051	0.9902	546.77	20.59
0.8090	1.1078	0.9939	602.64	20.66
0.8840	1.2105	0.9964	658.51	20.72
0.9590	1.3132	0.9988	714.38	20.76
1.0340	1.4159	1.0000	770.24	20.79

DATE 51568 RUN NO. 1

N= 2 X= 53.46 IN. UG= 37.52 FT/SEC REDELTA2= 1410.0

CF/2= 0.00238 VWALL/UG= 0.00000 K= 0.794E-06

VWALLPLUS= 0.0000 PPLUS= -0.00685

DEL= 0.883 IN. DELTA2= 0.0736 IN. H= 1.288

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0068	0.2992	5.61	6.14
0.0070	0.0079	0.3414	6.54	7.01
0.0080	0.0091	0.3683	7.48	7.56
0.0090	0.0102	0.4010	8.42	8.23
0.0100	0.0113	0.4333	9.34	8.88
0.0110	0.0125	0.4650	10.28	9.54
0.0130	0.0147	0.5027	12.15	10.31
0.0150	0.0170	0.5347	14.02	10.96
0.0170	0.0193	0.5663	15.89	11.62
0.0190	0.0215	0.5896	17.76	12.09
0.0220	0.0249	0.6159	20.56	12.63
0.0250	0.0283	0.6386	23.37	13.10
0.0290	0.0328	0.6618	27.10	13.57
0.0350	0.0396	0.6829	32.71	14.01
0.0450	0.0510	0.7113	42.06	14.59
0.0570	0.0645	0.7343	53.28	15.06
0.0700	0.0793	0.7545	65.43	15.48
0.0850	0.0963	0.7732	79.44	15.86
0.1050	0.1189	0.7924	98.14	16.25
0.1250	0.1415	0.8082	116.83	16.58
0.1500	0.1699	0.8286	140.20	17.00
0.1750	0.1982	0.8409	163.57	17.25
0.2100	0.2378	0.8549	196.29	17.54
0.2500	0.2831	0.8714	233.67	17.88
0.3000	0.3397	0.8894	280.40	18.24
0.3500	0.3963	0.9044	327.13	18.55
0.4250	0.4813	0.9234	397.23	18.94
0.5000	0.5662	0.9404	467.33	19.29
0.5750	0.6511	0.9546	537.43	19.58
0.6500	0.7360	0.9629	607.53	19.75
0.7250	0.8210	0.9743	677.64	19.99
0.8000	0.9059	0.9848	747.74	20.20
0.8750	0.9909	0.9897	817.84	20.30
0.9500	1.0758	0.9928	887.94	20.37
1.0250	1.1607	0.9944	958.04	20.40
1.1000	1.2456	0.9976	1028.14	20.46
1.1750	1.3305	1.0000	1098.24	20.51

DATE 51568 RUN NO. 1

N= 3 X= 66.83 IN. UG= 46.08 FT/SEC REDELTA2= 1350.4

CF/2= 0.00228 VWALL/UG= 0.00000 K= 0.759E-06

VWALLPLUS= 0.0000 PPLUS= -0.00694

DEL= 0.766 IN. DELTA2= 0.0574 IN. H= 1.301

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0091	0.3511	7.87	7.34	0.949
0.0080	0.0104	0.3921	9.00	8.20	0.942
0.0090	0.0117	0.4448	10.12	9.31	0.936
0.0100	0.0130	0.4656	11.24	9.74	0.930
0.0110	0.0144	0.4877	12.37	10.20	0.924
0.0120	0.0157	0.5170	13.49	10.82	0.918
0.0140	0.0183	0.5599	15.74	11.71	0.907
0.0160	0.0209	0.5919	17.99	12.38	0.897
0.0180	0.0235	0.6128	20.23	12.82	0.887
0.0210	0.0274	0.6405	23.61	13.40	0.874
0.0240	0.0313	0.6583	26.99	13.77	0.860
0.0290	0.0378	0.6865	32.61	14.36	0.840
0.0350	0.0457	0.7053	39.35	14.76	0.816
0.0440	0.0574	0.7295	49.47	15.26	0.783
0.0550	0.0718	0.7501	61.84	15.69	0.745
0.0680	0.0887	0.7709	76.45	16.13	0.703
0.0850	0.1109	0.7917	95.57	16.56	0.653
0.1050	0.1370	0.8140	118.05	17.03	0.600
0.1250	0.1631	0.8306	140.54	17.38	0.552
0.1500	0.1957	0.8512	168.65	17.81	0.498
0.1750	0.2284	0.8665	196.76	18.13	0.450
0.2100	0.2740	0.8869	236.11	18.55	0.391
0.2500	0.3262	0.9033	281.08	18.90	0.334
0.3000	0.3915	0.9218	337.30	19.29	0.275
0.3500	0.4567	0.9354	393.51	19.57	0.228
0.4000	0.5220	0.9454	449.74	19.78	0.187
0.4750	0.6199	0.9587	534.06	20.05	0.141
0.5500	0.7177	0.9690	618.39	20.28	0.106
0.6250	0.8156	0.9787	702.71	20.47	0.084
0.7000	0.9135	0.9862	787.03	20.63	0.071
0.7750	1.0113	0.9905	871.36	20.72	0.062
0.8500	1.1092	0.9963	955.68	20.85	0.061
0.9250	1.2071	0.9984	1040.01	20.89	0.061
1.0000	1.3050	0.9995	1124.33	20.91	0.061
1.0750	1.4028	1.0000	1208.66	20.92	0.062

DATE 51568 RUN NO. 1

N= 4 X= 77.79 IN. UG= 57.34 FT/SEC REDELTA2= 1283.4

CF/2= 0.00233 VWALL/UG= 0.00000 K= 0.788E-06

VWALLPLUS= 0.0000 PPLUS= -0.00700

DEL= 0.602 IN. DELTA2= 0.0439 IN. H= 1.301

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0100	0.3814	8.48	7.90	0.945
0.0070	0.0116	0.4291	9.89	8.98	0.937
0.0080	0.0133	0.4728	11.30	9.80	0.929
0.0090	0.0149	0.5134	12.72	10.63	0.922
0.0100	0.0166	0.5410	14.13	11.21	0.915
0.0110	0.0183	0.5662	15.54	11.73	0.908
0.0120	0.0199	0.5885	16.95	12.19	0.902
0.0130	0.0216	0.6028	18.37	12.48	0.896
0.0150	0.0249	0.6330	21.19	13.11	0.884
0.0170	0.0282	0.6509	24.02	13.48	0.873
0.0200	0.0332	0.6735	28.26	13.95	0.856
0.0230	0.0382	0.6925	32.49	14.35	0.841
0.0270	0.0448	0.7098	38.15	14.70	0.821
0.0320	0.0531	0.7254	45.21	15.02	0.798
0.0390	0.0647	0.7434	55.10	15.39	0.767
0.0470	0.0780	0.7606	66.41	15.76	0.734
0.0570	0.0946	0.7791	80.54	16.14	0.695
0.0690	0.1145	0.7985	97.49	16.54	0.652
0.0820	0.1361	0.8153	115.86	16.88	0.610
0.0970	0.1610	0.8342	137.05	17.28	0.565
0.1170	0.1942	0.8531	165.31	17.67	0.512
0.1370	0.2274	0.8693	193.58	18.00	0.465
0.1570	0.2606	0.8844	221.84	18.32	0.423
0.1770	0.2938	0.8973	250.10	18.58	0.387
0.2020	0.3353	0.9118	285.42	18.86	0.346
0.2320	0.3851	0.9242	327.80	19.14	0.306
0.2720	0.4515	0.9387	384.33	19.44	0.261
0.3220	0.5345	0.9527	454.97	19.74	0.217
0.3720	0.6174	0.9634	525.62	19.95	0.185
0.4220	0.7004	0.9721	596.27	20.13	0.161
0.4970	0.8249	0.9808	702.25	20.32	0.135
0.5720	0.9494	0.9881	808.21	20.46	0.121
0.6470	1.0739	0.9928	914.19	20.56	0.114
0.7220	1.1984	0.9969	1020.16	20.65	0.113
0.7970	1.3229	0.9986	1126.13	20.69	0.113
0.8970	1.4888	0.9993	1267.43	20.70	0.112
0.9970	1.6548	1.0000	1408.72	20.71	0.113

DATE 73069 RUN NO. 1

M= 1 X= 13.78 IN. UG= 25.25 FT/SEC REDELTA2= 912.9

CF/2= 0.00230 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.00000

DEL= 0.566 IN. DELTA2= 0.0701 IN. H= 1.455

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0124	0.2496	4.33	5.20
0.0080	0.0141	0.2699	4.94	5.63
0.0090	0.0159	0.2827	5.56	5.99
0.0100	0.0177	0.2949	6.18	6.16
0.0120	0.0212	0.3596	7.42	7.51
0.0140	0.0247	0.3833	8.65	8.00
0.0170	0.0300	0.4431	10.51	9.24
0.0200	0.0353	0.4679	12.36	9.77
0.0240	0.0424	0.5166	14.83	10.78
0.0280	0.0494	0.5380	17.29	11.23
0.0330	0.0583	0.5712	20.38	11.92
0.0380	0.0671	0.5953	23.47	12.42
0.0450	0.0795	0.6184	27.80	12.91
0.0540	0.0954	0.6435	33.36	13.42
0.0680	0.1201	0.6623	42.02	13.82
0.0880	0.1555	0.6984	54.37	14.57
0.1080	0.1907	0.7104	66.73	14.83
0.1330	0.2349	0.7422	82.17	15.48
0.1580	0.2790	0.7586	97.62	15.42
0.1980	0.3497	0.7925	122.33	16.54
0.2380	0.4203	0.8229	147.04	17.17
0.2830	0.4998	0.8522	174.85	17.78
0.3330	0.5881	0.8826	205.74	18.41
0.3830	0.6764	0.9157	236.63	19.11
0.4330	0.7647	0.9440	267.52	19.70
0.4830	0.8530	0.9625	298.41	20.09
0.5580	0.9855	0.9894	344.74	20.64
0.6330	1.1179	0.9947	391.08	20.75
0.7080	1.2504	0.9982	437.42	20.83
0.7830	1.3829	1.0000	483.75	20.86

DATE 73069 RUN NO. 1

M= 2 X= 29.67 IN. UG= 31.[illegible] FT/SEC REDELTA2= 944.1

CF/2= 0.00245 VWALL/UG= 0.00100 K= 0.138E-05

VWALLPLUS= 0.0000 PPLUS= -0.01137

DEL= 0.665 IN. DELTA2= 0.0595 IN. H= 1.342

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0105	0.2564	5.50	5.49
0.0080	0.0120	0.3333	6.29	6.73
0.0090	0.0135	0.3565	7.07	7.20
0.0100	0.0150	0.3760	7.86	7.59
0.0120	0.0181	0.4280	9.44	8.64
0.0140	0.0211	0.4813	11.01	9.72
0.0160	0.0241	0.5183	12.58	10.46
0.0180	0.0271	0.5508	14.16	11.11
0.0200	0.0301	0.5694	15.73	11.50
0.0230	0.0346	0.6041	18.08	12.19
0.0260	0.0391	0.6329	20.44	12.77
0.0300	0.0451	0.6598	23.59	13.31
0.0350	0.0527	0.6839	27.52	13.80
0.0430	0.0647	0.7105	33.81	14.34
0.0530	0.0797	0.7408	41.67	14.95
0.0630	0.0948	0.7623	49.53	15.39
0.0730	0.1098	0.7723	57.39	15.59
0.0900	0.1354	0.7953	70.76	16.05
0.1080	0.1625	0.8037	84.91	16.22
0.1330	0.2001	0.8236	104.56	16.62
0.1630	0.2452	0.8417	128.15	16.99
0.2130	0.3204	0.8607	167.46	17.38
0.2530	0.3806	0.8819	198.91	17.81
0.3030	0.4559	0.9040	238.23	18.25
0.3530	0.5312	0.9192	277.53	18.56
0.4030	0.6063	0.9342	316.84	18.86
0.4530	0.6815	0.9514	356.15	19.21
0.5030	0.7567	0.9659	395.46	19.50
0.5530	0.8319	0.9776	434.78	19.73
0.6030	0.9071	0.9825	474.09	19.83
0.6530	0.9824	0.9884	513.39	19.95
0.7280	1.0952	0.9988	572.36	20.17
0.8030	1.2080	1.0000	631.32	20.19

DATE 73068 RUN NO. 1

M= 3 X= 37.69 IN. UG= 37.76 FT/SEC REDELTA2= 824.9

CF/2= 0.00252 VWALL/UG= 0.00000 K= 0.144E-05

VWALLPLUS= 0.0000 PPLUS= -0.01135

DEL= 0.535 IN. DELTA2= 0.0428 IN. H= 1.344

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0131	0.3346	6.77	6.66	0.927
0.0080	0.0150	0.3612	7.74	7.19	0.918
0.0090	0.0168	0.3943	8.71	7.85	0.909
0.0100	0.0187	0.4465	9.67	8.89	0.900
0.0110	0.0206	0.4621	10.64	9.20	0.891
0.0120	0.0224	0.4853	11.62	9.66	0.883
0.0140	0.0262	0.5418	13.55	10.79	0.867
0.0160	0.0299	0.5783	15.49	11.51	0.852
0.0180	0.0337	0.6048	17.42	12.04	0.839
0.0210	0.0393	0.6364	20.33	12.67	0.819
0.0240	0.0449	0.6677	23.23	13.29	0.801
0.0270	0.0505	0.6908	26.13	13.75	0.784
0.0310	0.0580	0.7176	30.00	14.29	0.762
0.0350	0.0654	0.7349	33.88	14.63	0.742
0.0410	0.0767	0.7590	39.68	15.11	0.714
0.0480	0.0897	0.7763	46.45	15.46	0.683
0.0560	0.1047	0.7875	54.19	15.67	0.653
0.0660	0.1234	0.8033	63.88	16.00	0.611
0.0810	0.1514	0.8245	78.40	16.41	0.558
0.1010	0.1888	0.8433	97.75	16.78	0.494
0.1260	0.2356	0.8617	121.95	17.16	0.422
0.1560	0.2916	0.8842	150.98	17.60	0.357
0.1960	0.3664	0.9052	189.70	18.03	0.269
0.2460	0.4599	0.9267	238.09	18.45	0.191
0.2960	0.5534	0.9435	286.48	18.78	0.133
0.3460	0.6469	0.9542	334.86	19.00	0.082
0.3960	0.7403	0.9657	383.26	19.23	0.048
0.4460	0.8338	0.9770	431.65	19.45	0.027
0.4960	0.9273	0.9826	480.04	19.56	0.010
0.5460	1.0208	0.9921	528.43	19.75	0.007
0.5960	1.1142	0.9953	576.83	19.81	0.004
0.6460	1.2077	0.9969	625.22	19.84	0.002
0.7210	1.3479	0.9984	697.80	19.87	0.001
0.7960	1.4882	0.9992	770.39	19.89	-0.000
0.8710	1.6284	1.0000	842.98	19.90	0.001

DATE 73068 RUN NO. 1

M= 4 X= 45.64 IN. UG= 48.70 FT/SEC REDELTA2= 774.8

CF/2= 0.00248 VWALL/UG= 0.00000 K= 0.145E-05

VWALLPLUS= 0.0000 PPLUS= -0.01172

DEL= 0.430 IN. DELTA2= 0.0312 IN. H= 1.355

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0163	0.4291	8.66	8.62	0.907
0.0080	0.0185	0.4462	9.89	8.96	0.895
0.0090	0.0209	0.4792	11.13	9.63	0.884
0.0100	0.0233	0.5226	12.37	10.50	0.874
0.0110	0.0256	0.5481	13.60	11.01	0.864
0.0120	0.0279	0.5659	14.84	11.37	0.854
0.0140	0.0326	0.6124	17.31	12.30	0.836
0.0160	0.0372	0.6417	19.79	12.89	0.819
0.0180	0.0419	0.6712	22.25	13.48	0.804
0.0200	0.0465	0.6906	24.73	13.87	0.789
0.0230	0.0535	0.7135	28.44	14.33	0.768
0.0260	0.0605	0.7344	32.15	14.75	0.748
0.0290	0.0675	0.7484	35.86	15.03	0.724
0.0330	0.0768	0.7646	40.81	15.36	0.706
0.0400	0.0931	0.7865	49.46	15.80	0.667
0.0500	0.1164	0.8090	61.83	16.25	0.617
0.0620	0.1443	0.8297	76.67	16.67	0.563
0.0750	0.1746	0.8466	92.74	17.01	0.513
0.0950	0.2211	0.8686	117.47	17.45	0.439
0.1150	0.2677	0.8896	142.21	17.87	0.383
0.1400	0.3259	0.9085	173.12	18.24	0.317
0.1700	0.3957	0.9268	210.22	18.61	0.253
0.2000	0.4655	0.9436	247.32	18.97	0.212
0.2400	0.5586	0.9538	296.78	19.16	0.162
0.2750	0.6401	0.9635	340.06	19.35	0.133
0.3250	0.7565	0.9737	401.89	19.56	0.095
0.3750	0.8729	0.9814	463.72	19.71	0.074
0.4250	0.9892	0.9896	525.54	19.88	0.065
0.4750	1.1056	0.9943	587.37	19.97	0.062
0.5250	1.2220	0.9981	649.20	20.05	0.063
0.5750	1.3384	0.9991	711.03	20.07	0.063
0.6250	1.4548	1.0000	772.86	20.09	0.065

DATE 73068 RUN NO. 1

N= 5 X= 61.77 IN. UG= 71.73 FT/SEC REDELTA2= 1288.7

CF/2= 0.00222 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.358 IN. DELTA2= 0.0359 IN. H= 1.399

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0167	0.4041	10.18	8.58
0.0070	0.0195	0.4547	11.88	9.66
0.0080	0.0223	0.4930	13.58	10.47
0.0090	0.0251	0.5196	15.28	11.03
0.0100	0.0279	0.5440	16.98	11.55
0.0110	0.0307	0.5619	18.68	11.93
0.0130	0.0363	0.5851	22.06	12.51
0.0150	0.0419	0.6071	25.45	12.89
0.0170	0.0475	0.6210	28.85	13.18
0.0200	0.0558	0.6395	33.96	13.57
0.0230	0.0642	0.6499	39.03	13.79
0.0270	0.0754	0.6649	45.82	14.12
0.0330	0.0921	0.6832	56.00	14.50
0.0400	0.1117	0.7016	67.88	14.89
0.0480	0.1340	0.7202	81.46	15.29
0.0580	0.1619	0.7395	98.42	15.70
0.0700	0.1954	0.7619	118.79	16.18
0.0830	0.2317	0.7842	140.85	16.65
0.0980	0.2736	0.8093	166.30	17.18
0.1130	0.3154	0.8314	191.75	17.65
0.1280	0.3573	0.8519	217.21	18.09
0.1430	0.3992	0.8706	242.67	18.48
0.1580	0.4411	0.8870	268.12	18.83
0.1830	0.5109	0.9121	310.55	19.37
0.2080	0.5806	0.9328	352.97	19.81
0.2330	0.6504	0.9506	395.39	20.18
0.2580	0.7202	0.9646	437.81	20.48
0.2930	0.8179	0.9778	497.21	20.76
0.3330	0.9296	0.9871	565.08	20.96
0.3830	1.0692	0.9928	649.94	21.08
0.4330	1.2087	0.9966	734.78	21.16
0.4830	1.3483	0.9980	819.63	21.19
0.5330	1.4879	0.9987	904.49	21.20
0.5830	1.6275	0.9998	989.33	21.23
0.6330	1.7670	1.0000	1074.18	21.23

DATE 73068 RUN NO. 1

N= 6 X= 69.76 IN. UG= 71.35 FT/SEC REDELTA2= 1865.6

CF/2= 0.00191 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.450 IN. DELTA2= 0.0516 IN. H= 1.[illegible]

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0133	0.3606	9.49	8.24
0.0070	0.0155	0.3822	11.07	8.74
0.0080	0.0178	0.4179	12.65	9.56
0.0090	0.0200	0.4522	14.22	10.34
0.0100	0.0222	0.4794	15.81	10.96
0.0120	0.0266	0.5170	18.96	11.82
0.0140	0.0311	0.5426	22.13	12.41
0.0160	0.0355	0.5647	25.29	12.91
0.0190	0.0422	0.5841	30.03	13.35
0.0230	0.0511	0.6147	36.36	13.93
0.0290	0.0644	0.6257	45.85	14.32
0.0390	0.0866	0.6529	61.65	14.93
0.0540	0.1199	0.6819	85.36	15.59
0.0690	0.1532	0.7063	109.08	16.15
0.0890	0.1976	0.7335	140.69	16.77
0.1090	0.2420	0.7610	172.30	17.40
0.1290	0.2864	0.7846	203.92	17.94
0.1490	0.3309	0.8070	235.53	18.45
0.1740	0.3864	0.8323	275.05	19.03
0.1990	0.4419	0.8555	314.58	19.56
0.2240	0.4974	0.8743	354.10	19.99
0.2540	0.5640	0.8984	401.52	20.54
0.2840	0.6306	0.9180	448.94	20.99
0.3190	0.7083	0.9420	504.27	21.54
0.3540	0.7861	0.9602	559.60	21.95
0.3890	0.8638	0.9747	614.92	22.28
0.4290	0.9526	0.9870	678.16	22.56
0.4690	1.0414	0.9926	741.39	22.69
0.5090	1.1302	0.9964	804.61	22.78
0.5590	1.2413	0.9982	883.66	22.82
0.6190	1.3745	0.9998	978.50	22.86
0.6940	1.5410	1.0000	1097.06	22.86

DATE 73068 RUN NO. 1

N= 7 X= 85.78 IN. UG= 71.20 FT/SEC REDELTA2= 2865.5

CF/2= 0.00175 VWALL/UG= 0.00000 K= 0.000E 00

VWALLPLUS= 0.0000 PPLUS= 0.0000

DEL= 0.6[illegible] IN. DELTA2= 0.0790 IN. H= 1.385

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0091	0.3385	9.09	8.10
0.0070	0.0107	0.3631	10.60	8.70
0.0080	0.0122	0.3979	12.12	9.53
0.0090	0.0137	0.4206	13.63	10.06
0.0100	0.0152	0.4617	15.15	11.06
0.0110	0.0168	0.4819	16.66	11.54
0.0130	0.0198	0.5078	19.70	12.15
0.0150	0.0228	0.5249	22.73	12.57
0.0180	0.0274	0.5480	27.27	13.11
0.0220	0.0335	0.5698	33.33	13.64
0.0280	0.0426	0.5911	42.42	14.15
0.0370	0.0563	0.6128	56.05	14.67
0.0500	0.0761	0.6379	75.75	15.27
0.0700	0.1066	0.6677	106.05	15.98
0.0900	0.1371	0.6915	136.35	16.55
0.1100	0.1675	0.7123	166.65	17.05
0.1350	0.2056	0.7352	204.52	17.[illegible]
0.1600	0.2436	0.7571	242.40	18.13
0.1900	0.2893	0.7804	287.84	18.68
0.2250	0.3426	0.8036	340.88	19.23
0.2600	0.3959	0.8256	393.90	19.76
0.3100	0.4721	0.8527	469.65	20.41
0.3600	0.5482	0.8795	545.40	21.05
0.4100	0.6243	0.9038	621.15	21.64
0.4600	0.7005	0.9275	696.90	22.21
0.5100	0.7766	0.9494	772.65	22.73
0.5600	0.8528	0.9679	848.40	23.17
0.6100	0.9289	0.9806	924.15	23.47
0.6600	1.0050	0.9907	999.90	23.72
0.7100	1.0812	0.9958	1075.65	23.84
0.7850	1.1954	0.9991	1189.27	23.92
0.8600	1.3096	1.0000	1302.97	23.93

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	$F \times 10^3$	$K \times 10^6$	RE_{δ_2}	H	$K(H+1)RE_{\delta_2}-F$	$C_f/2 \times 10^3$: MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$: SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$: BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
51068/4	±0.02	±0.09	±0.02	$\pm10\%$	$\pm2.5\%$	±0.04	±0.25	±0.30	±0.15		±8.0
M = 1	29.90	39.14	0.98	0.0	1893	1.409	--	--	1.73	1.75	11.2
M = 2	53.86	48.58	1.00	0.589	2104	1.312	1.87	1.71	1.71	1.82	3.1
M = 3	66.83	60.00	0.98	0.587	2044	1.308	1.79	1.73	1.55	1.79	3.4
M = 4	77.79	75.15	1.01	0.613	[illegible]	1.300	1.83	1.75	1.59	1.83	3.9
50768/4	±0.02	±0.12	±0.02	$\pm14\%$	$\pm4.1\%$	±0.07	±0.40	±0.50	±0.25		±7.0
M = 1	29.90	30.43	1.01	0.0	1409	1.406	--	--	2.21	1.90	11.3
M = 2	53.86	37.80	1.01	0.800	1714	1.316	2.16	2.06	2.17	1.97	-1.1
M = 3	66.83	46.62	0.99	0.753	1682	1.310	1.94	1.79	1.86	1.94	0.5
M = 4	77.79	58.16	1.00	0.806	1635	1.308	2.04	1.85	1.84	1.91	-2.4
81368/8	±0.02	±0.10	±0.02	$\pm10\%$	$\pm4.0\%$	±0.075	±0.35	±0.55	±0.25		±7.0
M = 1	13.78	25.74	1.01	0.0	1050	1.487	--	--	2.19	2.00	-9.5
M = 2	29.67	31.83	0.99	1.37	1121	1.356	2.63	2.26	2.24	2.25	-2.5
M = 3	37.69	39.16	0.99	1.42	1061	1.334	2.52	2.07	2.29	2.29	-3.0
M = 4	45.64	50.47	1.01	1.47	974	1.357	2.36	2.25	1.97	2.25	-1.5
M = 5	49.63	59.04	1.01	1.46	962	1.347	2.28	2.16	2.07	2.28	-4.6
M = 6	61.77	73.73	1.00	0.0	1741	1.434	--	--	1.33	1.75	-1.4
M = 7	69.70	73.76	1.00	0.0	2477	1.443	--	--	1.20	1.54	-0.7
M = 8	85.78	73.68	0.99	0.0	3933	1.439	--	--	1.10	1.36	-1.0

SETUP DATA

VWALL/UG= 0.001

RUN:	51068-1	50768-1	81368-1
PBARO (IN. HG) =	29.94	29.82	29.34
TAMBIENT (DEG-F) =	71.2	75.0	73.5
RELATIVE HUMIDITY =	0.45	0.45	0.53
TGAS (DEG-F) =	67.31	70.59	66.89
GAS DENSITY (LBM/FT3) =	0.0753	0.0742	0.0748
GAS VISCOSITY (FT2/SEC) =	0.162E-03	0.165E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	39.23	0.00288	30.44	0.00225	25.74	0.00194
3.953	39.23		30.44		25.74	
5.953	39.23	0.00289	30.44	0.00226	25.78	0.00193
7.961	39.23		30.44		25.74	
9.969	39.20	0.00290	30.44	0.00229	25.74	0.00195
11.953	39.23		30.46		25.74	
13.937	39.24	0.00293	30.48	0.00228	25.74	0.00194
15.945	39.23		30.48		25.82	
17.953	39.22	0.00290	30.47	0.00224	25.95	0.00196
19.922	39.17		30.44		26.50	
21.938	39.14	0.00290	30.41	0.00223	27.24	0.00201
23.954	39.03		30.38		28.08	
25.962	39.11	0.00292	30.42	0.00227	29.09	0.00220
27.962	39.11		30.42		30.42	
29.978	39.14	0.00290	30.43	0.00228	31.82	0.00235
31.939	39.20		30.48		33.23	
33.955	39.37	0.00292	30.70	0.00229	34.87	0.00260
35.955	39.59		30.81		36.80	
37.971	40.04	0.00298	31.17	0.00232	38.84	0.00290
39.987	40.75		31.67		41.21	
41.963	41.56	0.00310	32.27	0.00241	43.68	0.00326
43.963	42.56		32.96		46.78	
45.963	43.59	0.00328	33.77	0.00250	50.21	0.00379
47.979	44.73		34.75		54.38	
49.979	46.05	0.00345	35.68	0.00265	59.20	0.00445
51.979	47.42		36.73		64.81	
53.995	48.88	0.00365	37.88	0.00284	70.55	0.00533
55.971	50.31		39.05		72.43	
57.971	51.96	0.00386	40.19	0.00300	72.37	0.00548
59.955	53.66		41.56		72.40	
61.979	55.40	0.00416	42.95	0.00322	72.37	0.00548
63.971	57.31		44.39		72.40	
65.979	59.27	0.00441	45.94	0.00341	72.43	0.00551
67.963	61.50		47.57		72.54	
69.971	63.90	0.00498	49.41	0.00367	72.57	0.00550
71.979	66.54		51.51		72.65	
73.963	69.39	0.00521	53.63	0.00402	72.67	0.00547
75.939	72.32		55.87		72.51	
77.947	75.79	0.00570	58.53	0.00433	72.55	0.00550
79.939	79.57		61.46		72.51	
81.931	83.78	0.00622	64.70	0.00478	72.52	0.00544
83.962	88.34		68.13		72.48	
85.931	93.22	0.00698	71.97	0.00531	72.49	0.00544
87.915	98.58		76.14		72.42	
89.939	104.70	0.00783	80.74	0.00598	72.38	0.00530
91.931	111.42		85.86		72.42	
93.947	118.84	0.00890	91.53	0.00677	72.43	0.00543

DATE 51068 RUN NO. 1

N= 1 X= 29.90 IN. UG= 33.14 FT/SEC REDELTA2= 1993.1

CF/2= 0.00175 VWALL/UG= 0.00098 K= 0.000E 00

VWALLPLUS= 0.0235 PPLUS= 0.00000

DEL= 0.836 IN. DELTA2= 0.0937 IN. H= 1.4[illegible]9

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0084	0.2660	5.90	6.36
0.0080	0.0096	0.2970	6.74	7.10
0.0090	0.0108	0.3228	7.59	7.72
0.0100	0.0120	0.3404	8.44	8.14
0.0110	0.0132	0.3768	9.27	9.01
0.0130	0.0156	0.4132	10.96	9.88
0.0150	0.0179	0.4403	12.64	10.53
0.0170	0.0203	0.4626	14.33	11.07
0.0200	0.0239	0.4916	16.86	11.75
0.0230	0.0275	0.5132	19.39	12.27
0.0280	0.0335	0.5406	23.61	12.93
0.0330	0.0395	0.5616	27.82	13.43
0.0390	0.0467	0.5794	32.89	13.86
0.0460	0.0550	0.5942	38.79	14.21
0.0540	0.0646	0.6134	45.53	14.67
0.0630	0.0754	0.6297	53.12	15.06
0.0730	0.0874	0.6411	61.55	15.33
0.0840	0.1005	0.6545	70.83	15.65
0.0960	0.1149	0.6698	80.95	16.02
0.1100	0.1316	0.6826	92.75	16.33
0.1250	0.1496	0.6994	105.40	16.73
0.1450	0.1735	0.7178	122.26	17.17
0.1700	0.2034	0.7386	143.34	17.66
0.1950	0.2333	0.7578	164.42	18.12
0.2200	0.2632	0.7740	185.53	18.51
0.2500	0.2991	0.7961	210.84	19.04
0.2850	0.3410	0.8177	240.36	19.56
0.3200	0.3829	0.8357	269.87	19.98
0.3550	0.4248	0.8523	299.39	20.39
0.3950	0.4727	0.8725	333.13	20.87
0.4350	0.5205	0.8922	366.78	21.34
0.4750	0.5684	0.9082	400.51	21.72
0.5250	0.6282	0.9287	442.67	22.21
0.5750	0.6880	0.9449	484.83	22.59
0.6350	0.7598	0.9594	535.41	22.95
0.6950	0.8316	0.9743	586.01	23.31
0.7650	0.9154	0.9803	645.03	23.45
0.8450	1.0111	0.9913	712.49	23.71
0.9450	1.1308	0.9956	796.81	23.81
1.0450	1.2504	0.9988	881.12	23.89
1.1450	1.3701	1.0000	965.44	23.92

DATE 51068 RUN NO. 1

N= 2 X= 53.46 IN. UG= 48.58 FT/SEC REDELTA2= 2173.9

CF/2= 0.00[illegible] VWALL/UG= 0.00100 K= [illegible].599E

VWALLPLUS= 0.0233 PPLUS= -0.00755

DEL= 0.918 IN. DELTA2= 0.0841 IN. H= 1.312

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0076	0.3243	7.49	7.59
0.0080	0.0087	0.3587	8.55	8.40
0.0090	0.0098	0.4008	9.61	9.38
0.0100	0.0109	0.4236	10.69	9.91
0.0110	0.0120	0.4452	11.75	10.42
0.0120	0.0131	0.4719	12.83	11.05
0.0140	0.0153	0.5055	14.96	11.83
0.0160	0.0174	0.5309	17.10	12.43
0.0180	0.0196	0.5568	19.24	13.03
0.0200	0.0218	0.5735	21.38	13.42
0.0230	0.0251	0.5912	24.58	13.84
0.0270	0.0294	0.6123	28.85	14.33
0.0340	0.0370	0.6379	36.34	14.93
0.0410	0.0447	0.6575	43.81	15.39
0.0490	0.0534	0.6758	52.36	15.82
0.0590	0.0643	0.6950	63.05	16.27
0.0740	0.0806	0.7189	79.09	16.83
0.0890	0.0970	0.7357	95.11	17.22
0.1090	0.1188	0.7596	116.49	17.78
0.1290	0.1405	0.7755	137.86	18.16
0.1490	0.1623	0.7929	159.24	18.56
0.1690	0.1841	0.8059	180.61	18.86
0.1940	0.2114	0.8209	207.33	19.21
0.2240	0.2440	0.8373	239.39	19.59
0.2590	0.2822	[illegible]	276.79	20.01
0.2940	0.3203	[illegible]	314.20	20.30
0.3440	0.3748	[illegible]	367.64	20.70
0.3940	0.4293	0.8985	421.07	21.03
0.4440	0.4837	0.9099	474.51	21.30
0.5190	0.5654	0.9299	554.66	21.77
0.5940	0.6472	0.9464	634.81	22.16
0.6690	0.7289	0.9587	714.97	22.44
0.7690	0.8378	0.9767	821.83	22.86
0.8690	0.9468	0.9868	928.71	23.10
0.9690	1.0557	0.9934	1035.58	23.25
1.0690	1.1647	0.9972	1142.45	23.34
1.1690	1.2736	0.9986	1249.32	23.38
1.2690	1.3826	1.0000	1356.19	23.41

DATE 51068 RUN NO. 1

N= 3 X= 66.83 IN. UG= [illegible] FT/SEC REDELTA2= 2043.5

CF/2= 0.00179 VWALL/UG= 0.00098 K= 0.597E-06

VWALLPLUS= 0.0231 PPLUS= -0.00777

DEL= 0.816 IN. DELTA2= 0.0662 IN. H= 1.308

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0086	0.3675	9.14	8.69	1.135
0.0080	0.0098	0.3988	10.44	9.43	1.143
0.0090	0.0110	0.4400	11.75	10.40	1.157
0.0100	0.0123	0.4750	13.05	11.23	1.169
0.0110	0.0135	0.4991	14.37	11.80	1.174
0.0120	0.0147	0.5185	15.67	12.26	1.177
0.0130	0.0159	[illegible]	16.98	12.68	1.179
0.0140	0.0172	0.5496	18.28	13.00	1.180
0.0160	0.0196	0.5733	20.89	13.56	1.179
0.0180	0.0221	0.5917	23.50	13.99	1.175
0.0210	0.0257	0.6133	27.42	14.50	1.168
0.0230	0.0282	0.6222	30.03	14.71	1.160
0.0260	0.0319	[illegible]	33.96	15.03	1.149
0.0300	0.0368	0.6513	39.16	15.40	1.134
0.0350	0.0429	0.6672	45.70	15.78	1.115
0.0410	0.0502	0.6823	53.53	16.14	1.090
0.0480	0.0588	0.6992	62.66	16.54	1.062
0.0560	0.0686	0.7145	73.12	16.90	1.030
0.0660	0.0809	0.7315	86.17	17.30	0.991
0.0790	0.0968	0.7507	103.14	17.76	0.943
0.0940	0.1152	0.7709	122.72	18.24	0.891
0.1110	0.1363	0.7891	144.92	18.66	0.833
0.1300	0.1593	0.8076	169.72	19.10	0.774
0.1510	0.1851	0.8265	197.14	19.55	0.715
0.1740	0.2133	0.8435	227.17	19.95	0.655
0.1940	0.2378	0.8558	253.29	20.24	0.606
0.2240	0.2745	0.8726	292.44	20.64	0.539
0.2640	0.3236	0.8928	344.67	21.12	0.463
0.3170	0.3885	0.9105	413.87	21.53	0.374
0.3670	0.4498	0.9277	479.14	21.94	0.307
0.4170	0.5111	0.9376	544.43	22.19	0.248
0.4670	0.5723	0.9487	609.71	22.44	0.20[illegible]
0.5170	0.6336	0.9584	674.97	22.67	0.162
0.5920	0.7255	0.9674	772.90	22.88	0.113
0.6670	0.8175	0.9776	870.41	23.12	0.080
0.7670	0.9400	0.9863	1001.37	23.33	0.052
0.8670	1.0626	0.9936	1131.92	23.51	0.039
0.9670	1.1851	0.9975	1262.48	23.59	0.033
1.0670	1.3077	0.9988	1393.04	23.62	0.031
1.1670	1.4303	1.0000	1523.60	23.65	0.031

DATE 51068 RUN NO. 1

N= 4 X= 77.79 IN. UG= 75.15 FT/SEC REDELTA2= 2017.2

CF/2= 0.00183 VWALL/UG= 0.00101 K= 0.613E-06

VWALLPLUS= 0.0236 PPLUS= -0.00781

DEL= 0.671 IN. DELTA2= 0.0522 IN. H= 1.300

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0089	0.4163	9.92	9.72	1.158
0.0070	0.0104	0.4455	11.57	10.41	1.164
0.0080	0.0119	0.4953	13.23	11.57	1.182
0.0090	0.0134	0.5231	14.88	12.22	1.187
0.0100	0.0149	0.5445	16.54	12.71	1.190
0.0110	0.0164	0.5615	18.19	13.11	1.190
0.0130	0.0194	0.58[illegible]	21.49	13.75	1.188
0.0150	0.0223	0.6083	24.80	14.21	1.183
0.0170	0.0253	0.6233	28.11	14.56	1.175
0.0200	0.0298	0.6414	33.07	14.98	1.162
0.0240	0.0358	0.6595	39.69	15.41	1.142
0.0290	0.0432	0.6759	47.95	15.81	1.116
0.0350	0.0521	0.6961	57.87	16.26	1.086
0.0450	0.0670	0.7200	74.41	16.82	1.035
0.0550	0.0819	0.7391	90.95	17.27	0.986
0.0650	0.0968	0.7586	107.48	17.72	0.941
0.0750	0.1117	0.7747	124.02	18.10	0.897
0.0870	0.1296	0.7918	143.85	18.50	0.847
0.1000	0.1490	0.8076	165.36	18.87	0.796
0.1150	0.1713	0.8240	190.17	19.25	0.741
0.1350	0.2011	0.8428	223.24	19.69	0.674
0.1550	0.2309	0.8599	256.30	20.09	0.614
0.1750	0.2607	0.8740	289.38	20.42	0.559
0.2000	0.2979	0.8881	330.73	20.74	0.496
0.2300	0.3426	0.9043	380.33	21.12	0.431
0.2650	0.3947	0.9203	438.21	21.50	0.367
0.3000	0.4469	0.9320	496.08	21.77	0.311
0.3400	0.5065	0.9448	562.23	22.07	0.260
0.3800	0.5660	0.9533	628.37	22.27	0.215
0.4300	0.6405	0.9633	711.05	22.51	0.171
0.4800	0.7150	0.9711	793.74	22.69	0.136
0.5400	0.8044	0.9787	892.95	22.87	0.105
0.6000	0.8938	0.9839	992.17	22.98	0.081
0.6750	1.0055	0.9903	1116.19	23.13	0.063
0.7500	1.1172	0.9943	1240.21	23.23	0.052
0.8250	1.2289	0.9974	1364.23	23.30	0.048
0.9000	1.3406	0.9984	1488.24	23.32	0.045
0.9750	1.4524	0.9992	1612.26	23.34	0.044
1.0500	1.5641	0.9998	1736.28	23.35	0.044
1.1250	1.6758	1.0000	1860.30	23.36	0.044

DATE 51768 RUN NO. 1

X= 1 X= 29.90 IN. UG= 33.43 FT/SEC REDELTA2= 1429.2

CF/2= 0.00199 VWALL/UG= 0.00171 K= 0.000E 00

VWALLPLUS= 0.0231 PPLUS= 0.00000

DEL= 0.851 IN. DELTA2= 0.0916 IN. H= 1.456

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0082	0.2545	4.73	5.94
0.0080	0.0094	0.2865	5.37	6.57
0.0090	0.0106	0.3070	6.04	7.04
0.0110	0.0129	0.3406	7.39	7.90
0.0130	0.0153	0.3647	8.72	8.02
0.0160	0.0188	0.4324	10.74	9.91
0.0190	0.0223	0.4674	12.75	10.72
0.0220	0.0258	0.5006	14.76	11.47
0.0260	0.0305	0.5260	17.44	12.06
0.0300	0.0352	0.5419	20.13	12.42
0.0380	0.0446	0.5827	25.50	13.37
0.0460	0.0540	0.6054	30.86	13.88
0.0550	0.0646	0.6212	36.90	14.25
0.0700	0.0822	0.6461	46.97	14.81
0.0900	0.1057	0.6719	60.39	15.41
0.1100	0.1292	0.6967	73.81	15.97
0.1300	0.1527	0.7139	87.23	16.36
0.1550	0.1821	0.7340	104.01	16.83
0.1800	0.2114	0.7586	120.78	17.38
0.2050	0.2408	0.7743	137.56	17.75
0.2550	0.2995	0.8065	171.11	18.49
0.3050	0.3583	0.8346	204.65	19.13
0.3550	0.4170	0.8618	238.20	19.76
0.4050	0.4758	0.8841	271.76	20.27
0.4550	0.5345	0.9111	305.31	20.89
0.5050	0.5932	0.9282	338.86	21.28
0.5550	0.6520	0.9374	372.41	21.49
0.6350	0.7461	0.9604	426.73	22.02
0.7050	0.8282	0.9754	473.05	22.37
0.7800	0.9163	0.9853	523.39	22.60
0.8550	1.0044	0.9902	573.71	22.70
0.9300	1.0925	0.9927	624.03	22.76
1.0050	1.1806	0.9951	674.36	22.81
1.0800	1.2687	0.9976	724.69	22.87
1.1550	1.3568	1.0000	775.01	22.93

DATE 51768 RUN NO. 1

X= 2 X= 53.06 IN. UG= 37.90 FT/SEC REDELTA2= 1713.7

CF/2= 0.00197 VWALL/UG= 0.00101 K= 0.400E-06

VWALLPLUS= 0.0229 PPLUS= -0.00913

DEL= 0.997 IN. DELTA2= 0.0997 IN. H= 1.316

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0060	0.2673	5.09	6.01
0.0070	0.0070	0.2954	5.94	6.65
0.0080	0.0080	0.3211	6.79	7.23
0.0090	0.0090	0.3494	7.63	7.87
0.0100	0.0100	0.3734	8.49	8.40
0.0110	0.0110	0.3997	9.33	9.00
0.0120	0.0120	0.4263	10.18	9.60
0.0130	0.0130	0.4409	11.03	9.93
0.0150	0.0151	0.4752	12.73	10.70
0.0170	0.0171	0.5072	14.42	11.42
0.0190	0.0191	0.5315	16.12	11.96
0.0220	0.0221	0.5631	18.67	12.68
0.0250	0.0251	0.5837	21.21	13.14
0.0300	0.0301	0.6126	25.46	13.79
0.0350	0.0351	0.6341	29.70	14.28
0.0420	0.0421	0.6566	35.65	14.77
0.0500	0.0502	0.6726	42.44	15.14
0.0620	0.0622	0.6945	52.62	15.63
0.0750	0.0753	0.7139	63.65	16.06
0.0900	0.0903	0.7341	76.38	16.53
0.1100	0.1104	0.7521	93.36	16.93
0.1350	0.1355	0.7768	114.57	17.49
0.1650	0.1656	0.7968	140.03	17.94
0.2000	0.2007	0.8183	169.74	18.42
0.2400	0.2408	0.8420	203.69	18.95
0.2800	0.2810	0.8546	237.63	19.23
0.3200	0.3211	0.8668	271.58	19.51
0.3700	0.3713	0.8839	314.01	19.90
0.4300	0.4315	0.9007	364.93	20.27
0.4950	0.4967	0.9180	420.10	20.67
0.5700	0.5720	0.9341	483.75	21.03
0.6450	0.6472	0.9483	547.40	21.35
0.7200	0.7225	0.9599	611.05	21.60
0.8200	0.8229	0.9745	695.92	21.93
0.9200	0.9232	0.9857	780.79	22.19
1.0200	1.0236	0.9913	865.66	22.32
1.1200	1.1239	0.9976	950.53	22.46
1.2200	1.2242	0.9992	1035.39	22.49
1.3200	1.3246	1.0000	1120.26	22.51

DATE 51768 RUN NO. 1

X= 3 X= 65.03 IN. UG= 46.62 FT/SEC REDELTA2= 1682.0

CF/2= 0.00194 VWALL/UG= 0.00099 K= 0.753E-06

VWALLPLUS= 0.0224 PPLUS= -0.00879

DEL= 0.876 IN. DELTA2= 0.0714 IN. H= 1.310

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0080	0.3350	7.27	7.48	1.107
0.0080	0.0091	0.3657	8.31	8.29	1.117
0.0090	0.0103	0.3959	9.35	8.97	1.127
0.0100	0.0114	0.4319	10.39	9.80	1.136
0.0110	0.0126	0.4575	11.42	10.38	1.142
0.0120	0.0137	0.4742	12.46	10.76	1.143
0.0140	0.0160	0.5130	14.54	11.64	1.149
0.0160	0.0183	0.5443	16.61	12.34	1.152
0.0180	0.0206	0.5685	18.69	12.89	1.151
0.0200	0.0228	0.5864	20.77	13.30	1.149
0.0230	0.0263	0.6089	23.88	13.82	1.143
0.0260	0.0297	0.6265	27.00	14.21	1.135
0.0300	0.0343	0.6452	31.15	14.64	1.123
0.0350	0.0400	0.6618	36.35	15.01	1.105
0.0400	0.0457	0.6750	41.53	15.31	1.087
0.0470	0.0537	0.6939	48.81	15.74	1.063
0.0550	0.0628	0.7094	57.11	16.09	1.035
0.0650	0.0742	0.7245	67.49	16.44	0.999
0.0800	0.0913	0.7436	83.07	16.86	0.946
0.0950	0.1085	0.7655	98.64	17.36	0.899
0.1100	0.1256	0.7809	114.22	17.71	0.853
0.1350	0.1542	0.8063	140.19	18.29	0.784
0.1600	0.1827	0.8235	166.14	18.67	0.718
0.1850	0.2113	0.8434	192.10	19.13	0.661
0.2100	0.2398	0.8574	218.06	19.45	0.607
0.2450	0.2798	0.8770	254.40	19.90	0.542
0.2850	0.3255	0.8923	295.94	20.24	0.474
0.3350	0.3826	0.9083	347.85	20.60	0.399
0.3850	0.4397	0.9230	399.77	20.95	0.338
0.4350	0.4968	0.9358	451.69	21.23	0.297
0.5100	0.5825	0.9501	529.57	21.55	0.225
0.5850	0.6681	0.9604	607.44	21.78	0.175
0.6850	0.7823	0.9722	711.28	22.05	0.120
0.7850	0.8965	0.9838	815.12	22.32	0.102
0.8850	1.0103	0.9906	918.95	22.46	0.088
0.9850	1.1244	0.9948	1022.79	22.58	0.080
1.0850	1.2392	0.9970	1126.62	22.63	0.079
1.1850	1.3536	0.9985	1230.46	22.67	0.079
1.2850	1.4676	1.0000	1334.31	22.68	0.079

DATE 51768 RUN NO. 1

X= 4 X= 77.79 IN. UG= 58.16 FT/SEC REDELTA2= 1635.0

CF/2= 0.00191 VWALL/UG= 0.00129 K= 0.836E-06

VWALLPLUS= 0.0237 PPLUS= -0.00966

DEL= 0.714 IN. DELTA2= 0.0557 IN. H= 1.308

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0084	0.3547	7.70	8.12	1.117
0.0070	0.0098	0.3861	8.98	8.84	1.123
0.0080	0.0112	0.4239	10.27	9.70	1.132
0.0090	0.0126	0.4593	11.55	10.51	1.141
0.0100	0.0140	0.4908	12.83	11.23	1.148
0.0110	0.0154	0.5133	14.11	11.75	1.151
0.0120	0.0168	0.5349	15.40	12.24	1.153
0.0130	0.0182	0.5515	16.68	12.62	1.153
0.0150	0.0210	0.5820	19.25	13.32	1.153
0.0170	0.0238	0.6033	21.81	13.81	1.148
0.0190	0.0266	0.6191	24.38	14.17	1.141
0.0220	0.0308	0.6387	28.23	14.62	1.129
0.0260	0.0364	0.6582	33.36	15.06	1.111
0.0300	0.0420	0.6751	38.49	15.45	1.093
0.0350	0.0490	0.6893	44.91	15.77	1.068
0.0420	0.0588	0.7069	53.89	16.18	1.033
0.0500	0.0701	0.7259	64.16	16.61	0.996
0.0600	0.0841	0.7436	76.99	17.02	0.949
0.0700	0.0981	0.7604	89.82	17.40	0.905
0.0800	0.1121	0.7760	102.65	17.76	0.864
0.0900	0.1261	0.7892	115.48	18.06	0.824
0.1050	0.1471	0.8071	134.73	18.47	0.768
0.1200	0.1681	0.8218	153.98	18.81	0.715
0.1400	0.1962	0.8402	179.64	19.23	0.651
0.1600	0.2242	0.8559	205.30	19.59	0.593
0.1800	0.2522	0.8686	230.97	19.88	0.539
0.2000	0.2802	0.8808	256.63	20.16	0.490
0.2250	0.3153	0.8947	288.71	20.47	0.436
0.2500	0.3503	0.9065	320.78	20.74	0.387
0.2850	0.3993	0.9196	365.69	21.04	0.327
0.3250	0.4554	0.9332	417.02	21.36	0.273
0.3750	0.5254	0.9467	481.18	21.67	0.212
0.4250	0.5955	0.9565	545.33	21.89	0.164
0.5000	0.7006	0.9693	641.57	22.18	0.112
0.5750	0.8057	0.9792	737.81	22.41	0.079
0.6500	0.9108	0.9859	834.04	22.56	0.057
0.7500	1.0509	0.9923	962.35	22.71	0.040
0.8500	1.1910	0.9963	1090.67	22.80	0.034
0.9500	1.3311	0.9983	1218.98	22.85	0.031
1.0500	1.4712	0.9997	1347.29	22.88	0.032
1.1500	1.6113	1.0000	1475.61	22.89	0.032

DATE 81369 RUN NO. 1

N= 1 X= 13.78 IN. UG= 25.74 FT/SEC REDELTA2= 1049.5

CF/2= 0.00200 VWALL/UG= 0.00131 K= 0.0000E 00

VWALLPLUS= 0.0225 PPLUS= 0.00300

DEL= 0.630 IN. DELTA2= 0.0796 IN. H= 1.487

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0127	0.2513	4.72	5.41
0.0090	0.0143	0.2692	5.31	6.09
0.0100	0.0159	0.2757	5.90	6.17
0.0120	0.0191	0.3425	7.07	7.65
0.0140	0.0222	0.3664	8.26	8.19
0.0160	0.0254	0.3909	9.44	8.73
0.0190	0.0302	0.4379	11.20	9.79
0.0230	0.0365	0.4613	13.57	10.31
0.0290	0.0460	0.5160	17.13	11.53
0.0350	0.0556	0.5353	20.65	11.97
0.0440	0.0699	0.5774	25.95	12.90
0.0540	0.0857	0.6002	31.85	13.42
0.0660	0.1049	0.6303	38.93	14.10
0.0790	0.1254	0.6420	46.59	14.35
0.0940	0.1493	0.6667	55.45	14.90
0.1140	0.1810	0.6866	67.24	15.35
0.1390	0.2207	0.7130	81.99	15.93
0.1690	0.2684	0.7376	99.69	16.49
0.2090	0.3319	0.7724	123.28	17.26
0.2490	0.3954	0.7998	146.87	17.88
0.2940	0.4668	0.8308	173.41	18.57
0.3440	0.5462	0.8646	202.92	19.33
0.3940	0.6256	0.9008	232.42	20.13
0.4440	0.7050	0.9320	261.90	20.84
0.4940	0.7844	0.9552	291.39	21.36
0.5690	0.9035	0.9761	335.62	21.82
0.6440	1.0226	0.9932	379.86	22.21
0.7190	1.1417	0.9983	424.13	22.31
0.7940	1.2609	1.0000	468.34	22.36

DATE 81369 RUN NO. 1

N= 2 X= 29.67 IN. UG= 31.43 FT/SEC REDELTA2= 1120.8

CF/2= 0.00225 VWALL/UG= 0.00099 K= 0.137E-05

VWALLPLUS= 0.0209 PPLUS= -0.01288

DEL= 0.699 IN. DELTA2= 0.0647 IN. H= 1.356

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0101	0.2717	5.43	5.73
0.0080	0.0116	0.2851	6.18	6.10
0.0090	0.0130	0.3285	6.96	6.93
0.0100	0.0145	0.3513	7.72	7.41
0.0120	0.0174	0.4041	9.28	8.53
0.0140	0.0203	0.4479	10.82	9.45
0.0160	0.0232	0.4924	12.36	10.39
0.0180	0.0261	0.5108	13.90	10.78
0.0210	0.0304	0.5479	16.22	11.56
0.0240	0.0349	0.5806	18.54	12.25
0.0270	0.0391	0.6030	20.86	12.72
0.0310	0.0449	0.6231	23.95	13.15
0.0360	0.0522	0.6538	27.82	13.79
0.0420	0.0609	0.6834	32.45	14.42
0.0490	0.0710	0.6946	37.86	14.65
0.0570	0.0826	0.7165	44.04	15.12
0.0720	0.1044	0.7421	55.63	15.66
0.0870	0.1261	0.7554	67.23	15.94
0.1070	0.1551	0.7783	82.67	16.42
0.1320	0.1913	0.7965	101.99	16.81
0.1620	0.2348	0.8156	125.17	17.21
0.1970	0.2855	0.8343	152.21	17.60
0.2470	0.3580	0.8602	190.85	18.15
0.2970	0.4305	0.8818	229.49	18.60
0.3470	0.5029	0.9040	268.11	19.07
0.3970	0.5754	0.9161	306.74	19.32
0.4720	0.6841	0.9398	364.69	19.83
0.5470	0.7928	0.9585	422.64	20.23
0.6220	0.9015	0.9789	480.59	20.66
0.6970	1.0102	0.9912	538.54	20.91
0.7720	1.1189	0.9978	596.49	21.05
0.8470	1.2275	1.0000	654.44	21.10

DATE 81368 RUN NO. 1

N= 3 X= 37.69 IN. UG= 37.16 FT/SEC REDELTA2= 1061.3

CF/2= 0.00224 VWALL/UG= 0.00099 K= 0.142E-05

VWALLPLUS= 0.0207 PPLUS= -0.01293

DEL= 0.630 IN. DELTA2= 0.0529 IN. H= 1.334

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0111	0.3377	6.72	7.06	1.066
0.0080	0.0127	0.3704	7.68	7.74	1.068
0.0090	0.0143	0.4042	8.64	8.45	1.072
0.0100	0.0159	0.4354	9.60	9.10	1.075
0.0110	0.0175	0.4645	10.56	9.71	1.078
0.0120	0.0190	0.4949	11.51	10.34	1.082
0.0140	0.0222	0.5262	13.43	11.00	1.078
0.0160	0.0254	0.5610	15.35	11.73	1.076
0.0180	0.0286	0.5851	17.27	12.23	1.071
0.0210	0.0333	0.6213	20.15	12.99	1.064
0.0240	0.0381	0.6363	23.03	13.30	1.049
0.0280	0.0444	0.6654	26.87	13.91	1.033
0.0320	0.0508	0.6869	30.71	14.35	1.017
0.0370	0.0587	0.7047	35.50	14.73	0.994
0.0430	0.0683	0.7187	41.26	15.03	0.963
0.0530	0.0841	0.7419	50.86	15.51	0.919
0.0650	0.1030	0.7584	62.45	15.85	0.873
0.0780	0.1238	0.7820	74.85	16.35	0.812
0.0930	0.1476	0.8022	89.24	16.77	0.755
0.1100	0.1746	0.8193	105.55	17.12	0.694
0.1280	0.2032	0.8351	122.82	17.46	0.636
0.1470	0.2340	0.8494	142.01	17.75	0.575
0.1730	0.2746	0.8644	166.00	18.06	0.505
0.2080	0.3302	0.8858	199.58	18.51	0.424
0.2480	0.3937	0.9037	237.97	18.88	0.344
0.2980	0.4731	0.9228	285.95	19.29	0.265
0.3480	0.5524	0.9407	333.92	19.66	0.206
0.3980	0.6318	0.9531	381.89	19.92	0.162
0.4480	0.7112	0.9613	429.87	20.09	0.124
0.5230	0.8302	0.9757	501.84	20.39	0.095
0.5980	0.9493	0.9880	573.81	20.65	0.089
0.6730	1.0683	0.9927	645.77	20.74	0.082
0.7730	1.2271	0.9993	741.73	20.88	0.091
0.8730	1.3858	1.0000	837.67	20.90	0.093

DATE 81368 RUN NO. 1

N= 4 X= 45.64 IN. UG= 52.47 FT/SEC REDELTA2= 974.1

CF/2= 0.00225 VWALL/UG= 0.00101 K= 0.147E-05

VWALLPLUS= 0.0212 PPLUS= -0.01371

DEL= 0.492 IN. DELTA2= 0.0377 IN. H= 1.357

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0142	0.3698	8.59	7.79	1.055
0.0080	0.0163	0.4134	9.81	8.71	1.061
0.0090	0.0183	0.4538	11.04	9.56	1.065
0.0100	0.0203	0.4892	12.26	10.31	1.068
0.0110	0.0224	0.5238	13.49	11.03	1.071
0.0120	0.0244	0.5427	14.72	11.44	1.068
0.0140	0.0285	0.5884	17.17	12.40	1.065
0.0160	0.0325	0.6160	19.62	12.98	1.056
0.0180	0.0366	0.6355	22.07	13.39	1.045
0.0210	0.0427	0.6640	25.75	13.98	1.029
0.0240	0.0488	0.6848	29.43	14.43	1.011
0.0280	0.0569	0.7037	34.33	14.82	0.985
0.0340	0.0692	0.7264	41.69	15.30	0.946
0.0420	0.0854	0.7531	51.51	15.86	0.896
0.0520	0.1058	0.7720	63.77	16.26	0.836
0.0640	0.1302	0.7935	78.48	16.71	0.768
0.0790	0.1607	0.8177	96.88	17.23	0.692
0.0970	0.1973	0.8436	118.95	17.77	0.612
0.1140	0.2319	0.8611	139.79	18.14	0.543
0.1340	0.2725	0.8787	164.33	18.51	0.472
0.1590	0.3234	0.8972	194.98	18.90	0.394
0.1890	0.3844	0.9158	231.77	19.29	0.315
0.2240	0.4556	0.9338	274.69	19.67	0.242
0.2590	0.5269	0.9460	317.61	19.93	0.182
0.2940	0.5980	0.9575	360.53	20.17	0.135
0.3340	0.6793	0.9675	409.59	20.38	0.094
0.3840	0.7810	0.9783	470.90	20.61	0.058
0.4340	0.8827	0.9845	532.21	20.74	0.033
0.5090	1.0352	0.9916	624.19	20.89	0.017
0.5840	1.1878	0.9982	716.16	21.03	0.004
0.6590	1.3403	0.9991	808.13	21.05	0.002
0.7340	1.4929	0.9996	900.10	21.06	0.001
0.8340	1.6962	1.0000	1022.73	21.07	0.001

DATE 81368 RUN NO. 1

N= 5 X= 49.63 IN. UG= 59.04 FT/SEC REDELTA2= 961.5

CF/2= 0.00228 VWALL/UG= 0.00131 K= 0.144E-05

VWALLPLUS= 0.0211 PPLUS= -0.01335

DEL= 0.423 IN. DELTA2= 0.0318 IN. H= 1.347

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0142	0.4008	8.66	8.39	1.071
0.0070	0.0165	0.4397	10.11	9.20	1.072
0.0080	0.0189	0.4808	11.55	10.06	1.075
0.0090	0.0213	0.5142	13.00	10.76	1.075
0.0110	0.0260	0.5794	15.88	12.04	1.076
0.0130	0.0307	0.6121	18.77	12.81	1.067
0.0150	0.0355	0.6437	21.66	13.47	1.058
0.0180	0.0426	0.6729	25.99	14.08	1.039
0.0220	0.0520	0.7027	31.76	14.71	1.012
0.0270	0.0638	0.7256	38.98	15.18	0.975
0.0340	0.0804	0.7504	49.08	15.70	0.925
0.0440	0.1040	0.7772	63.51	16.27	0.858
0.0540	0.1277	0.7995	77.95	16.73	0.796
0.0640	0.1513	0.8174	92.39	17.10	0.738
0.0790	0.1868	0.8390	114.04	17.55	0.659
0.0940	0.2222	0.8594	135.69	17.98	0.589
0.1090	0.2577	0.8757	157.35	18.32	0.527
0.1290	0.3050	0.8945	186.22	18.72	0.455
0.1540	0.3641	0.9122	222.30	19.09	0.377
0.1790	0.4232	0.9275	258.40	19.41	0.313
0.2040	0.4823	0.9402	294.48	19.68	0.261
0.2340	0.5532	0.9534	337.78	19.95	0.210
0.2640	0.6241	0.9628	381.10	20.14	0.170
0.2940	0.6950	0.9714	424.40	20.33	0.140
0.3340	0.7896	0.9793	482.15	20.[illegible]	0.110
0.3840	0.9078	0.9861	554.32	20.64	0.083
0.4590	1.0851	0.9936	662.58	20.79	0.062
0.5340	1.2624	0.9981	770.85	20.89	0.056
0.6090	1.4397	0.9997	879.12	20.92	0.054
0.6840	1.6170	1.0000	987.38	20.93	0.054

DATE 81369 RUN NO. 1

N= 6 X= 61.77 IN. UG= 73.73 FT/SEC REDELTA2= 1741.4

CF/2= 0.00175 VWALL/UG= 0.00130 K= 0.000E 00

VWALLPLUS= 0.0239 PPLUS= 0.00000

DEL= 0.428 IN. DELTA2= 0.0467 IN. H= 1.434

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0140	0.3537	9.44	8.47
0.0070	0.0164	0.3790	11.01	9.[illegible]
0.0080	0.0187	0.4143	12.59	9.92
0.0090	0.0210	0.4444	14.17	10.64
0.0100	0.0234	0.4652	15.73	11.14
0.0120	0.0281	0.5034	18.88	12.06
0.0150	0.0351	0.5397	23.61	12.92
0.0180	0.0421	0.5621	28.32	13.46
0.0220	0.0515	0.5844	34.61	13.99
0.0260	0.0608	0.6014	40.91	14.40
0.0330	0.0772	0.6252	51.92	14.97
0.0410	0.0959	0.6472	64.51	15.50
0.0510	0.1193	0.6690	80.25	16.02
0.0610	0.1427	0.6902	95.98	16.53
0.0710	0.1661	0.7090	111.73	16.98
0.0860	0.2011	0.7347	135.33	17.59
0.1010	0.2362	0.7584	158.93	18.16
0.1160	0.2713	0.7816	182.53	18.71
0.1310	0.3064	0.8021	206.13	19.20
0.1460	0.3415	0.8219	229.73	19.68
0.1610	0.3765	0.8412	253.34	20.14
0.1760	0.4116	0.8593	276.94	20.57
0.1960	0.4584	0.8794	308.41	21.05
0.2160	0.5052	0.8984	339.88	21.51
0.2410	0.5637	0.9196	379.23	22.02
0.2660	0.6221	0.9371	418.56	22.44
0.2910	0.6806	0.9517	457.90	22.79
0.3210	0.7508	0.9657	505.11	23.12
0.3710	0.8677	0.9811	583.78	23.50
0.4210	0.9846	0.9895	662.44	23.69
0.4960	1.1600	0.9957	780.47	23.85
0.5710	1.3355	0.9984	898.48	23.91
0.6460	1.5109	0.9999	1016.50	23.94
0.7210	1.6863	1.0000	1134.51	23.94

DATE 81368 RUN NO. 1

N= 7 X= 69.70 IN. UG= 73.76 FT/SEC REDELTA2= 2476.7

CF/2= 0.00154 VWALL/UG= 0.00130 K= 0.000E 00

VWALLPLUS= 0.0254 PPLUS= 0.00000

DEL= 0.533 IN. DELTA2= 0.0657 IN. H= 1.443

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0113	0.3203	8.89	8.15
0.0070	0.0131	0.3450	10.37	8.78
0.0080	0.0150	0.3764	11.85	9.58
0.0090	0.0169	0.4073	13.33	10.37
0.0100	0.0188	0.4289	14.81	10.92
0.0120	0.0225	0.4630	17.78	11.79
0.0140	0.0263	0.4881	20.74	12.42
0.0170	0.0319	0.5135	25.18	13.07
0.0210	0.0394	0.5377	31.11	13.69
0.0260	0.0488	0.5584	38.52	14.21
0.0320	0.0601	0.5782	47.41	14.72
0.0470	0.0882	0.6134	69.63	15.61
0.0620	0.1164	0.6416	91.84	16.33
0.0820	0.1539	0.6716	121.47	17.10
0.1020	0.1915	0.6986	151.09	17.77
0.1220	0.2290	0.7229	180.72	18.40
0.1420	0.2666	0.7453	210.35	18.97
0.1620	0.3041	0.7659	239.98	19.49
0.1820	0.3417	0.7860	269.60	20.00
0.2070	0.3886	0.8097	306.63	20.61
0.2320	0.4355	0.8325	343.67	21.18
0.2570	0.4825	0.8523	380.70	21.69
0.2820	0.5294	0.8713	417.74	22.17
0.3120	0.5857	0.8932	462.17	22.73
0.3420	0.6421	0.9141	506.61	23.26
0.3720	0.6984	0.9319	551.06	23.72
0.4120	0.7735	0.9533	610.31	24.26
0.4520	0.8486	0.9704	669.56	24.69
0.4920	0.9237	0.9824	728.82	25.00
0.5420	1.0175	0.9917	802.88	25.24
0.6170	1.1593	0.9977	913.98	25.39
0.6920	1.2991	0.9997	1025.08	25.43
0.7670	1.4399	1.0000	1136.19	25.44

DATE 81368 RUN NO. 1

N= 8 X= 85.78 IN. UG= 73.68 FT/SEC REDELTA2= 3933.3

CF/2= 0.00136 VWALL/UG= 0.00099 K= 0.000E 00

VWALLPLUS= 0.0268 PPLUS= 0.00000

DEL= 0.797 IN. DELTA2= 0.1045 IN. H= 1.439

Y.IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0075	0.2940	8.34	7.97
0.0070	0.0088	0.3137	9.72	8.51
0.0080	0.0100	0.3426	11.11	9.28
0.0090	0.0113	0.3725	12.51	10.09
0.0100	0.0126	0.3940	13.89	10.68
0.0120	0.0151	0.4242	16.66	11.50
0.0140	0.0176	0.4487	19.45	12.16
0.0160	0.0201	0.4681	22.23	12.69
0.0190	0.0239	0.4875	26.39	13.22
0.0230	0.0289	0.5045	31.95	13.68
0.0290	0.0364	0.5261	40.28	14.26
0.0390	0.0490	0.5513	54.17	14.94
0.0490	0.0615	0.5704	68.06	15.46
0.0590	0.0741	0.5864	81.96	15.89
0.0740	0.0929	0.6075	102.79	16.47
0.0940	0.1180	0.6301	130.57	17.08
0.1190	0.1494	0.6560	165.30	17.78
0.1440	0.1808	0.6792	200.03	18.41
0.1740	0.2184	0.7024	241.70	19.04
0.2090	0.2624	0.7266	290.31	19.70
0.2490	0.3126	0.7544	345.88	20.45
0.2890	0.3628	0.7810	401.44	21.17
0.3290	0.4130	0.8049	457.01	21.81
0.3690	0.4632	0.8264	512.57	22.40
0.4090	0.5134	0.8480	568.13	22.99
0.4590	0.5762	0.8729	637.58	23.66
0.5090	0.6390	0.8973	707.04	24.33
0.5590	0.7018	0.9198	776.49	24.93
0.6090	0.7645	0.9397	845.95	25.47
0.6590	0.8273	0.9579	915.40	25.97
0.7090	0.8901	0.9722	984.85	26.35
0.7840	0.9842	0.9888	1089.04	26.80
0.8590	1.0784	0.9959	1193.22	27.00
0.9340	1.1725	0.9981	1297.40	27.06
1.0090	1.2667	1.0000	1401.59	27.11

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	$F \times 10^3$	$K \times 10^6$	RE_{δ_2}	H	$K(H+1)RE_{\delta_2}-F$	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
42468/4	±0.02	±0.10	±0.02	±10%	±2.1%	±0.035	±0.30	±0.35	±0.15		±8.0
M = 1	29.90	40.60	1.90	0.0	2291	1.450	--	--	1.47	1.47	11.0
M = 2	53.86	49.00	1.96	0.565	2751	1.336	1.67	1.35	1.56	1.56	4.0
M = 3	66.83	59.58	1.95	0.557	2630	1.319	1.45	1.42	1.42	1.58	3.5
M = 4	77.79	73.55	2.00	0.593	2619	1.311	1.59	1.56	1.26	1.59	0.5
42368/5	±0.02	±0.12	±0.03	±14%	±3.4%	±0.055	±0.50	±0.60	±0.20		±7.0
M = 1	29.90	30.18	1.98	0.0	1655	1.448	--	--	1.67	1.64	13.1
M = 2	53.86	36.56	1.98	0.754	2166	1.343	1.85	1.52	1.66	1.66	4.0
M = 3	66.83	44.62	1.94	0.753	2072	1.324	1.68	1.83	1.75	1.71	3.2
M = 4	77.79	55.16	1.99	0.801	2119	1.317	1.95	1.90	1.57	1.65	-0.3
M = 5	85.79	60.09	1.99	0.754	2108	1.320	1.70	1.65	1.38	1.70	0.1
81668/8	±0.02	±0.12	±0.02	±10%	±4.1%	±0.07	±0.40	±0.60	±0.25		±7.0
M = 1	13.78	25.78	2.00	0.0	1160	1.530	--	--	1.88	1.72	-13.1
M = 2	29.67	32.04	1.99	1.42	1264	1.377	2.28	2.03	1.94	2.03	-1.5
M = 3	37.69	39.23	2.03	1.42	1225	1.350	2.07	1.91	2.07	2.03	0.3
M = 4	45.64	50.88	2.04	1.48	1191	1.357	2.11	1.75	1.78	2.00	-0.5
M = 5	49.52	59.33	2.05	1.48	1151	1.364	1.96	1.56	1.67	2.00	0.3
M = 6	61.77	74.46	2.01	0.0	2112	1.457	--	--	1.09	1.45	3.0
M = 7	69.70	74.63	2.01	0.0	3054	1.488	--	--	0.92	1.28	-0.2
M = 8	85.78	74.61	1.99	0.0	4952	1.500	--	--	0.80	1.00	3.5

SETUP DATA

VWALL/UG= 0.002

RUN:	42468-1	42368-1	81668-1
PBARO (IN. HG) =	30.03	30.19	29.80
TAMBIENT (DEG-F) =	74.5	73.1	73.8
RELATIVE HUMIDITY =	0.45	0.45	0.51
TGAS (DEG-F) =	72.26	71.84	68.29
GAS DENSITY (LBM/FT3) =	0.0747	0.0749	0.0743
GAS VISCOSITY (FT2/SEC) =	0.164E-03	0.164E-03	0.164E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	40.85	0.00592	30.11	0.00445	25.64	0.00379
3.953	40.85		30.11		25.64	
5.953	40.85	0.00590	30.11	0.00448	25.80	0.00381
7.961	40.84		30.11		25.77	
9.969	40.76	0.00593	30.14	0.00445	25.77	0.00378
11.953	40.74		30.11		25.77	
13.937	40.84	0.00595	30.14	0.00451	25.78	0.00383
15.945	40.74		30.11		25.82	
17.953	40.79	0.00594	30.11	0.00452	25.99	0.00381
19.922	40.64		30.07		26.46	
21.938	40.62	0.00599	30.03	0.00451	27.25	0.00399
23.954	40.52		30.03		28.08	
25.962	40.57	0.00581	30.03	0.00447	29.14	0.00430
27.962	40.59		30.07		30.49	
29.978	40.60	0.00578	30.03	0.00448	31.89	0.00473
31.939	40.62		30.07		33.39	
33.955	40.74	0.00591	30.11	0.00449	35.16	0.00525
35.955	40.87		30.14		37.09	
37.971	41.23	0.00594	30.40	0.00451	39.21	0.00590
39.987	41.77		30.91		41.56	
41.963	42.38	0.00616	31.38	0.00475	44.20	0.00669
43.963	43.28		32.04		47.32	
45.963	44.19	0.00638	32.73	0.00476	50.94	0.00772
47.979	45.26		33.54		55.15	
49.979	46.43	0.00671	34.33	0.00514	60.13	0.00904
51.979	47.76		35.41		65.95	
53.995	49.10	0.00718	36.35	0.00543	71.91	0.01079
55.971	50.52		37.43		73.88	
57.971	51.98	0.00763	38.61	0.00583	73.89	0.01109
59.955	53.61		39.74		73.99	
61.979	55.26	0.00804	41.07	0.00625	73.93	0.01110
63.971	57.09		42.41		73.98	
65.979	58.99	0.00868	43.88	0.00650	74.01	0.01107
67.963	61.00		45.35		74.09	
69.971	63.20	0.00927	47.02	0.00695	74.12	0.01112
71.979	65.61		48.81		74.21	
73.963	68.25	0.01001	50.83	0.00750	74.31	0.01107
75.939	70.90		52.81		74.16	
77.947	74.07	0.01097	55.25	0.00821	74.21	0.01108
79.939	77.51		57.80		74.13	
81.931	81.30	0.01192	60.63	0.00897	74.18	0.01107
83.962	85.38		63.70		74.15	
85.931	89.76	0.01320	66.92	0.00994	74.09	0.01100
87.915	94.50		70.49		74.12	
89.939	99.78	0.01475	74.43	0.01109	74.12	0.01103
91.931	105.58		78.66		74.33	
93.947	112.06	0.01646	83.55	0.01243	74.37	0.01115

DATE 42468 RUN NO. 1

M= 1 X= 29.90 IN. UG= 40.60 FT/SEC REDELTA2= 2291.2

CF/2= 0.00147 VWALL/UG= 0.00190 K= 0.000E 00

VWALLPLUS= 0.0496 PPLUS= 0.0000

DEL= 0.932 IN. DELTA2= 0.1112 IN. H= 1.450

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0075	0.2493	5.53	6.53
0.0080	0.0086	0.2778	6.33	7.24
0.0090	0.0097	0.2921	7.12	7.62
0.0110	0.0118	0.3355	8.70	8.75
0.0130	0.0139	0.3736	10.28	9.74
0.0150	0.0161	0.4015	11.86	10.47
0.0170	0.0182	0.4261	13.44	11.10
0.0190	0.0204	0.4402	15.03	11.47
0.0220	0.0236	0.4641	17.39	12.09
0.0260	0.0279	0.4865	20.56	12.69
0.0310	0.0332	0.5047	24.51	13.15
0.0380	0.0408	0.5257	30.04	13.70
0.0480	0.0515	0.5497	37.95	14.32
0.0580	0.0622	0.5726	45.86	14.92
0.0680	0.0729	0.5901	53.76	15.37
0.0810	0.0869	0.6071	64.05	15.82
0.0930	0.0997	0.6236	73.53	16.25
0.1080	0.1158	0.6376	85.39	16.62
0.1280	0.1373	0.6564	101.21	17.10
0.1530	0.1641	0.6787	120.97	17.69
0.1780	0.1909	0.6984	140.74	18.20
0.2080	0.2231	0.7185	164.46	18.73
0.2380	0.2553	0.7417	188.19	19.32
0.2880	0.3088	0.7756	227.72	20.21
0.3380	0.3625	0.8048	267.26	20.97
0.3880	0.4162	0.8313	306.79	21.66
0.4380	0.4698	0.8562	346.32	22.31
0.4880	0.5234	0.8834	385.86	23.02
0.5380	0.5770	0.9002	425.39	23.46
0.6130	0.6575	0.9283	484.70	24.19
0.6880	0.7379	0.9507	544.00	24.77
0.7630	0.8184	0.9711	603.29	25.30
0.8380	0.8988	0.9825	662.60	25.62
0.9130	0.9793	0.9884	721.90	25.76
0.9880	1.0597	0.9946	781.21	25.92
1.0630	1.1402	0.9973	840.51	25.99
1.1380	1.2206	0.9993	899.80	26.04
1.2130	1.3010	1.0000	959.11	26.06

DATE 42468 RUN NO. 1

M= 2 X= 53.86 IN. UG= 49.[illegible] FT/SEC REDELTA2= 2751.[illegible]

CF/2= 0.00156 VWALL/UG= 0.00196 K= 0.565E-06

VWALLPLUS= 0.0497 PPLUS= -0.00918

DEL= 1.095 IN. DELTA2= 0.1117 IN. H= 1.336

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0055	0.2699	5.89	6.86
0.0070	0.0064	0.3054	6.87	7.74
0.0080	0.0073	0.3317	7.85	8.41
0.0090	0.0082	0.3548	8.83	8.98
0.0100	0.0091	0.3857	9.81	9.75
0.0110	0.0100	0.4056	10.79	10.37
0.0120	0.0110	0.4317	11.77	10.94
0.0130	0.0119	0.4445	12.76	11.26
0.0150	0.0137	0.4709	14.71	11.93
0.0180	0.0164	0.5034	17.66	12.75
0.0210	0.0192	0.5224	20.61	13.24
0.0260	0.0237	0.5536	25.51	14.03
0.0310	0.0283	0.5742	30.41	14.56
0.0380	0.0347	0.5941	37.29	15.05
0.0480	0.0438	0.6195	47.10	15.69
0.0610	0.0557	0.6402	59.85	16.21
0.0760	0.0694	0.6651	74.57	16.85
0.0910	0.0831	0.6851	89.29	17.36
0.1110	0.1013	0.7078	108.93	17.94
0.1310	0.1196	0.7260	128.52	18.39
0.1560	0.1424	0.7469	153.05	18.92
0.1860	0.1698	0.7690	182.49	19.47
0.2210	0.2018	0.7887	216.83	19.98
0.2610	0.238	0.8091	256.07	20.55
0.3060	0.2794	0.8267	300.23	20.94
0.3510	0.3205	0.8418	344.37	21.33
0.4110	0.3752	0.8631	403.24	21.87
0.4710	0.4300	0.8812	462.11	22.37
0.5460	0.4985	0.9016	535.70	22.84
0.6210	0.5670	0.9195	609.28	23.29
0.6960	0.6354	0.9356	682.86	23.70
0.7710	0.7039	0.9513	756.44	24.10
0.8460	0.7724	0.9630	830.03	24.40
0.9210	0.8408	0.9731	903.62	24.65
1.0210	0.9321	0.9840	1001.73	24.92
1.1210	1.0234	0.9921	1099.84	25.13
1.2210	1.1147	0.9963	1197.95	25.24
1.3210	1.2060	0.9981	1296.06	25.29
1.4210	1.2973	1.0000	1394.17	25.33

DATE 42468 RUN NO. 1

M= 3 X= 66.83 IN. UG= 59.58 FT/SEC REDELTA2= 2629.7

CF/2= 0.00158 VWALL/UG= 0.00195 K= 0.557E-06

VWALLPLUS= 0.0491 PPLUS= -0.00485

DEL= 0.989 IN. DELTA2= 0.0871 IN. H= 1.319

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0061	0.3099	7.21	7.78	1.321
0.0070	0.0071	0.3454	8.41	8.68	1.356
0.0080	0.0081	0.3826	9.61	9.62	1.393
0.0090	0.0091	0.4150	10.81	10.43	1.423
0.0100	0.0101	0.4365	12.02	10.97	1.441
0.0110	0.0111	0.4631	13.22	11.64	1.465
0.0120	0.0121	0.4778	14.42	12.01	1.475
0.0140	0.0141	0.5041	16.83	12.67	1.492
0.0160	0.0162	0.5255	19.23	13.20	1.502
0.0180	0.0182	0.5403	21.63	13.58	1.505
0.0200	0.0202	0.5547	24.03	13.94	1.508
0.0240	0.0243	0.5759	28.84	14.48	1.506
0.0280	0.0283	0.5921	33.65	14.88	1.498
0.0340	0.0344	0.6109	40.86	15.36	1.480
0.0420	0.0424	0.6362	50.47	15.99	1.459
0.0500	0.0505	0.6537	60.09	16.43	1.431
0.0600	0.0606	0.6704	72.11	16.85	1.392
0.0750	0.0758	0.6967	90.13	17.51	1.340
0.0900	0.0910	0.7198	108.15	18.10	1.290
0.1050	0.1061	0.7371	126.18	18.53	1.236
0.1200	0.1213	0.7544	144.21	18.96	1.187
0.1400	0.1415	0.7726	168.24	19.42	1.121
0.1650	0.1668	0.7943	198.29	19.97	1.046
0.1900	0.1920	0.8142	228.33	20.47	0.977
0.2150	0.2173	0.8284	258.37	20.82	0.908
0.2450	0.2476	0.8431	294.42	21.19	0.831
0.2850	0.2880	0.8638	342.49	21.71	0.742
0.3300	0.3335	0.8797	396.57	22.11	0.647
0.3800	0.3841	0.8953	456.65	22.50	0.554
0.4300	0.4346	0.9113	516.74	22.91	0.478
0.4800	0.4851	0.9234	576.83	23.21	0.409
0.5550	0.5609	0.9399	666.96	23.62	0.326
0.6300	0.6367	0.9522	757.09	23.93	0.258
0.7050	0.7125	0.9631	847.21	24.21	0.207
0.7800	0.7883	0.9729	937.35	24.45	0.170
0.8800	0.8894	0.9825	1057.52	24.69	0.137
0.9800	0.9905	0.9896	1177.68	24.87	0.117
1.0800	1.0915	0.9943	1297.86	24.99	0.107
1.1800	1.1926	0.9984	1418.03	25.10	0.106
1.2800	1.2937	0.9997	1538.21	25.13	0.105
1.3800	1.3948	1.0000	1658.38	25.14	0.106

DATE 42468 RUN NO. 1

M= 4 X= 77.79 IN. UG= 73.55 FT/SEC REDELTA2= 2618.7

CF/2= 0.00159 VWALL/UG= 0.00230 K= 0.593E-06

VWALLPLUS= 0.0501 PPLUS= -0.00934

DEL= 0.859 IN. DELTA2= 0.0703 IN. H= 1.311

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0070	0.3579	8.91	8.97	1.372
0.0070	0.0082	0.3857	10.40	9.67	1.395
0.0080	0.0093	0.4196	11.89	10.52	1.426
0.0090	0.0105	0.4555	13.37	11.41	1.464
0.0100	0.0116	0.4820	14.86	12.08	1.482
0.0110	0.0128	0.5001	16.35	12.54	1.495
0.0120	0.0140	0.5184	17.83	13.00	1.508
0.0130	0.0151	0.5310	19.32	13.31	1.513
0.0150	0.0175	0.5536	22.28	13.87	1.522
0.0170	0.0198	0.5694	25.26	14.28	1.523
0.0200	0.0233	0.5887	29.72	14.75	1.519
0.0240	0.0279	0.6067	35.67	15.21	1.507
0.0290	0.0338	0.6252	43.09	15.67	1.487
0.0340	0.0396	0.6431	50.53	16.12	1.468
0.0410	0.0477	0.6587	60.92	16.51	1.431
0.0490	0.0571	0.6776	72.81	16.98	1.394
0.0590	0.0687	0.6983	87.67	17.51	1.347
0.0690	0.0804	0.7173	102.53	17.99	1.302
0.0790	0.0920	0.7342	117.39	18.40	1.257
0.0940	0.1095	0.7539	139.68	18.90	1.190
0.1090	0.1269	0.7734	161.96	19.39	1.128
0.1240	0.1444	0.7888	184.26	19.77	1.066
0.1440	0.1677	0.8074	213.96	20.24	0.990
0.1640	0.1910	0.8254	243.68	20.69	0.920
0.1840	0.2143	0.8406	273.41	21.07	0.855
0.2090	0.2434	0.8563	310.55	21.46	0.778
0.2340	0.2725	0.8696	347.70	21.79	0.706
0.2640	0.3074	0.8840	392.27	22.16	0.629
0.2990	0.3482	0.8998	444.29	22.55	0.550
0.3340	0.3890	0.9117	496.29	22.84	0.478
0.3840	0.4472	0.9265	570.59	23.22	0.393
0.4340	0.5054	0.9396	644.89	23.55	0.318
0.4840	0.5637	0.9486	719.17	23.78	0.255
0.5590	0.6510	0.9612	830.62	24.09	0.181
0.6340	0.7383	0.9723	942.06	24.37	0.128
0.7340	0.8548	0.9818	1090.65	24.61	0.079
0.8340	0.9713	0.9898	1239.24	24.79	0.049
0.9340	1.0877	0.9938	1387.93	24.91	0.031
1.0340	1.2042	0.9971	1536.42	25.00	0.024
1.1340	1.3206	0.9990	1685.01	25.04	0.021
1.2340	1.4371	0.9996	1833.60	25.06	0.020
1.3340	1.5535	1.0000	1982.18	25.07	0.020

DATE 42368 RUN NO. 1

N= 1 X= 29.90 IN. UG= 30.18 FT/SEC REDELTA2= 1455.1

CF/2= 0.00164 VWALL/UG= 0.00198 K= 0.0000E 00

VWALLPLUS= 0.0490 PPLUS= 0.00000

DEL= 0.917 IN. DELTA2= 0.0976 IN. H= 1.448

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0087	0.2361	4.97	5.83
0.0090	0.0098	0.2659	5.60	6.45
0.0110	0.0120	0.3043	6.84	7.52
0.0130	0.0142	0.3387	8.08	8.39
0.0150	0.0164	0.3765	9.33	9.32
0.0170	0.0185	0.3956	10.57	9.78
0.0200	0.0218	0.4294	12.43	10.50
0.0230	0.0251	0.4481	14.33	11.08
0.0270	0.0294	0.4845	16.79	11.98
0.0310	0.0338	0.5019	19.28	12.41
0.0360	0.0393	0.5234	22.38	12.94
0.0420	0.0456	0.5417	26.12	13.40
0.0490	0.0534	0.5617	30.47	13.89
0.0590	0.0643	0.5809	36.68	14.37
0.0740	0.0807	0.6056	45.02	14.98
0.0890	0.0971	0.6255	55.34	15.47
0.1040	0.1134	0.6447	64.67	15.94
0.1190	0.1298	0.6616	74.00	16.36
0.1390	0.1516	0.6816	86.43	16.85
0.1640	0.1789	0.6993	101.99	17.29
0.1990	0.2170	0.7284	123.74	18.01
0.2390	0.2606	0.7564	149.62	18.70
0.2890	0.3152	0.7912	179.70	19.57
0.3390	0.3697	0.8185	210.80	20.24
0.3890	0.4242	0.8406	241.89	20.79
0.4390	0.4788	0.8621	272.97	21.32
0.4890	0.5333	0.8873	304.07	21.94
0.5390	0.5878	0.9077	335.15	22.45
0.5890	0.6423	0.9264	366.25	22.91
0.6640	0.7241	0.9460	412.89	23.39
0.7390	0.8059	0.9652	459.52	23.86
0.8140	0.8877	0.9790	506.15	24.21
0.8890	0.9695	0.9877	552.79	24.42
0.9640	1.0513	0.9939	599.42	24.58
1.0390	1.1331	0.9963	646.06	24.64
1.1140	1.2149	0.9988	692.69	24.70
1.1890	1.2967	1.0000	739.34	24.73

DATE 42368 RUN NO. 1

N= 2 X= 53.46 IN. UG= 36.56 FT/SEC REDELTA2= 2165.8

CF/2= 0.00166 VWALL/UG= 0.00198 K= 0.754E-06

VWALLPLUS= 0.0486 PPLUS= -0.01111

DEL= 1.147 IN. DELTA2= 0.1163 IN. H= 1.343

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0061	0.2479	5.32	6.08
0.0080	0.0070	0.2705	6.08	6.63
0.0090	0.0078	0.2999	6.84	7.35
0.0100	0.0087	0.3162	7.60	7.75
0.0120	0.0105	0.3654	9.11	8.96
0.0140	0.0122	0.4083	10.63	10.01
0.0160	0.0139	0.4398	12.15	10.78
0.0180	0.0157	0.4619	13.68	11.33
0.0210	0.0183	0.4899	15.95	12.01
0.0240	0.0209	0.5164	18.23	12.66
0.0270	0.0235	0.5386	20.50	13.20
0.0300	0.0262	0.5538	22.79	13.58
0.0340	0.0296	0.5745	25.82	14.09
0.0400	0.0349	0.5945	30.39	14.57
0.0460	0.0401	0.6069	34.94	14.88
0.0560	0.0488	0.6298	42.53	15.44
0.0660	0.0575	0.6519	50.13	15.99
0.0810	0.0706	0.6746	61.52	16.53
0.0960	0.0837	0.6904	72.92	16.93
0.1160	0.1011	0.7095	88.10	17.40
0.1410	0.1229	0.7337	107.10	17.98
0.1660	0.1447	0.7528	126.09	18.45
0.1960	0.1709	0.7714	148.86	18.91
0.2260	0.1970	0.7874	171.65	19.30
0.2660	0.2319	0.8062	202.04	19.76
0.3060	0.2668	0.8226	232.42	20.17
0.3460	0.3017	0.8357	262.80	20.49
0.3960	0.3453	0.8525	300.77	20.90
0.4460	0.3888	0.8670	338.76	21.25
0.5210	0.4542	0.8879	395.71	21.77
0.5960	0.5196	0.9055	452.69	22.20
0.6710	0.5850	0.9201	509.65	22.56
0.7460	0.6504	0.9354	566.61	22.93
0.8460	0.7376	0.9548	642.56	23.40
0.9460	0.8248	0.9695	718.52	23.77
1.0460	0.9120	0.9823	794.47	24.08
1.1460	0.9991	0.9900	870.43	24.27
1.2460	1.0863	0.9950	946.38	24.39
1.3460	1.1735	0.9983	1022.33	24.47
1.4460	1.2607	1.0000	1098.28	24.51

DATE 42368 RUN NO. 1

N= 3 X= 66.83 IN. UG= 44.62 FT/SEC REDELTA2= 2072.4

CF/2= 0.00171 VWALL/UG= 0.00194 K= 0.753E-06

VWALLPLUS= 0.0470 PPLUS= -0.01062

DEL= 1.008 IN. DELTA2= 0.0912 IN. H= 1.324

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0060	0.2705	5.64	6.54	1.252
0.0070	0.0069	0.3075	6.58	7.43	1.282
0.0080	0.0079	0.3368	7.52	8.14	1.307
0.0090	0.0089	0.3625	8.46	8.76	1.327
0.0100	0.0099	0.3864	9.40	9.34	1.346
0.0110	0.0109	0.4089	10.34	9.89	1.363
0.0130	0.0129	0.4543	12.22	10.98	1.398
0.0150	0.0149	0.4829	14.10	11.67	1.415
0.0170	0.0169	0.5111	15.98	12.36	1.432
0.0190	0.0189	0.5262	17.86	12.71	1.434
0.0220	0.0218	0.5522	20.68	13.35	1.442
0.0250	0.0248	0.5711	23.50	13.80	1.443
0.0290	0.0288	0.5885	27.26	14.22	1.436
0.0330	0.0327	0.6035	31.02	14.59	1.427
0.0390	0.0387	0.6236	36.66	15.07	1.412
0.0480	0.0476	0.6447	45.12	15.58	1.382
0.0580	0.0575	0.6678	54.52	16.14	1.351
0.0680	0.0675	0.6835	63.91	16.52	1.314
0.0830	0.0823	0.7045	78.02	17.03	1.260
0.0980	0.0972	0.7246	92.11	17.52	1.208
0.1180	0.1171	0.7476	110.91	18.07	1.141
0.1380	0.1369	0.7676	129.71	18.55	1.077
0.1580	0.1568	0.7828	148.51	18.92	1.014
0.1830	0.1815	0.8046	172.01	19.45	0.944
0.2080	0.2064	0.8196	195.51	19.81	0.874
0.2330	0.2312	0.8320	219.01	20.11	0.807
0.2730	0.2709	0.8526	256.61	20.61	0.711
0.3130	0.3105	0.8669	294.21	20.95	0.620
0.3580	0.3552	0.8848	336.51	21.38	0.531
0.4080	0.4048	0.8986	383.51	21.72	0.441
0.4580	0.4544	0.9128	430.51	22.06	0.362
0.5330	0.5288	0.9268	501.00	22.39	0.257
0.6330	0.6280	0.9471	594.99	22.88	0.149
0.7330	0.7273	0.9612	689.00	23.23	0.069
0.8330	0.8265	0.9733	782.99	23.53	0.011
0.9330	0.9257	0.9836	876.99	23.77	-0.028
1.0330	1.0249	0.9921	970.99	23.98	-0.049
1.1330	1.1241	0.9955	1064.98	24.06	-0.061
1.2330	1.2233	0.9983	1158.98	24.13	-0.067
1.3330	1.3226	1.0000	1252.97	24.17	-0.069

DATE 42368 RUN NO. 1

N= 4 X= 77.79 IN. UG= 55.16 FT/SEC REDELTA2= 2119.2

CF/2= 0.00165 VWALL/UG= 0.00199 K= 0.801E-06

VWALLPLUS= 0.0489 PPLUS= -0.01194

DEL= 0.914 IN. DELTA2= 0.0755 IN. H= 1.317

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0066	0.3116	6.84	7.67	1.297
0.0070	0.0077	0.3472	7.98	8.54	1.328
0.0080	0.0087	0.3756	9.12	9.24	1.350
0.0090	0.0098	0.4119	10.26	10.14	1.383
0.0100	0.0109	0.4352	11.40	10.71	1.400
0.0110	0.0120	0.4582	12.54	11.28	1.417
0.0120	0.0131	0.4801	13.68	11.81	1.432
0.0140	0.0153	0.5140	15.97	12.64	1.452
0.0160	0.0175	0.5363	18.25	13.20	1.460
0.0180	0.0197	0.5564	20.53	13.69	1.465
0.0200	0.0219	0.5720	22.81	14.08	1.465
0.0230	0.0252	0.5884	26.23	14.48	1.458
0.0270	0.0295	0.6074	30.80	14.94	1.445
0.0320	0.0350	0.6270	36.50	15.43	1.427
0.0390	0.0427	0.6466	44.49	15.91	1.394
0.0470	0.0514	0.6678	53.61	16.43	1.358
0.0570	0.0623	0.6883	65.01	16.93	1.309
0.0670	0.0733	0.7052	76.42	17.35	1.260
0.0770	0.0842	0.7206	87.83	17.73	1.211
0.0870	0.0952	0.7352	99.24	18.09	1.165
0.1020	0.1116	0.7563	116.34	18.61	1.101
0.1170	0.1280	0.7721	133.45	18.99	1.034
0.1320	0.1444	0.7876	150.56	19.38	0.974
0.1520	0.1662	0.8051	173.37	19.81	0.896
0.1770	0.1936	0.8258	201.89	20.32	0.808
0.2020	0.2209	0.8425	230.40	20.73	0.725
0.2320	0.2537	0.8557	264.63	21.16	0.634
0.2670	0.2920	0.8766	304.54	21.57	0.538
0.3020	0.3303	0.8907	344.47	21.92	0.452
0.3520	0.3850	0.9094	401.50	22.37	0.346
0.4020	0.4397	0.9246	458.53	22.75	0.258
0.4520	0.4943	0.9360	515.56	23.03	0.181
0.5270	0.5764	0.9492	601.11	23.35	0.085
0.6020	0.6584	0.9627	686.65	23.69	0.015
0.7020	0.7678	0.9740	800.71	23.97	-0.054
0.8020	0.8771	0.9823	914.77	24.17	-0.101
0.9020	0.9865	0.9893	1028.84	24.35	-0.129
1.0020	1.0959	0.9949	1142.90	24.48	-0.143
1.1020	1.2052	0.9971	1256.96	24.53	-0.150
1.2020	1.3146	0.9985	1371.02	24.57	-0.154
1.3020	1.4240	0.9996	1485.08	24.59	-0.155
1.4020	1.5333	1.0000	1599.14	24.60	-0.155

DATE 42369 RUN NO. 1

N= 5 X= 95.79 IN. UG= 65.69 FT/SEC REDELTA2= 2107.6

CF/2= 0.00170 VWALL/UG= 0.00139 K= 0.756E-06

VWALLPLUS= 0.0484 PPLUS= -0.01080

DEL= 0.769 IN. DELTA2= 0.0622 IN. H= 1.320

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0065	0.0085	0.3735	9.18	9.07	1.347
0.0075	0.0098	0.4137	10.48	10.04	1.382
0.0085	0.0111	0.4418	11.87	10.73	1.403
0.0095	0.0124	0.4736	13.27	11.50	1.428
0.0105	0.0137	0.4959	14.66	12.04	1.443
0.0115	0.0150	0.5128	16.06	12.45	1.451
0.0125	0.0163	0.5310	17.46	12.90	1.462
0.0135	0.0176	0.5427	18.85	13.18	1.465
0.0145	0.0189	0.5523	20.25	13.41	1.466
0.0155	0.0202	0.5631	21.64	13.67	1.468
0.0165	0.0215	0.5720	23.04	13.89	1.468
0.0185	0.0241	0.5876	25.84	14.26	1.466
0.0205	0.0267	0.6011	28.63	14.59	1.463
0.0235	0.0306	0.6135	32.82	14.89	1.449
0.0285	0.0371	0.6356	39.80	15.44	1.429
0.0355	0.0462	0.6577	49.59	15.97	1.394
0.0425	0.0553	0.6754	59.36	16.40	1.356
0.0495	0.0644	0.6926	69.13	16.82	1.320
0.0585	0.0761	0.7119	81.70	17.29	1.275
0.0685	0.0892	0.7307	95.67	17.74	1.224
0.0785	0.1022	0.7470	109.62	18.13	1.175
0.0885	0.1152	0.7616	123.59	18.49	1.128
0.0985	0.1282	0.7760	137.56	18.84	1.084
0.1085	0.1412	0.7888	151.52	19.15	1.041
0.1235	0.1607	0.8048	172.47	19.54	0.977
0.1385	0.1803	0.8191	193.41	19.88	0.917
0.1535	0.1998	0.8306	214.37	20.17	0.860
0.1735	0.2258	0.8474	242.29	20.57	0.791
0.1985	0.2584	0.8632	277.20	20.96	0.709
0.2285	0.2974	0.8833	319.11	21.44	0.627
0.2685	0.3495	0.9016	374.96	21.89	0.527
0.3085	0.4015	0.9181	430.83	22.30	0.445
0.3585	0.4666	0.9336	500.66	22.66	0.357
0.4085	0.5317	0.9459	570.48	22.97	0.285
0.4585	0.5964	0.9556	640.30	23.20	0.226
0.5085	0.6618	0.9658	710.13	23.45	0.182
0.5585	0.7269	0.9715	779.95	23.59	0.143
0.6335	0.8245	0.9802	884.69	23.80	0.101
0.7085	0.9221	0.9864	989.44	23.95	0.073
0.8085	1.0523	0.9924	1129.09	24.09	0.050
0.9085	1.1825	0.9962	1268.74	24.19	0.039
1.0335	1.3451	0.9980	1443.30	24.23	0.031
1.1335	1.4753	0.9992	1582.96	24.26	0.029
1.2335	1.6055	1.0000	1722.60	24.28	0.029

DATE 81668 RUN NO. 1

N= 1 X= 13.78 IN. UG= 25.78 FT/SEC REDELTA2= 1159.5

CF/2= 0.00172 VWALL/UG= 0.00230 K= 0.0000E 00

VWALLPLUS= 0.0482 PPLUS= 0.00000

DEL= 0.662 IN. DELTA2= 0.0886 IN. 1.530

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0121	0.2260	4.34	5.45
0.0090	0.0136	0.2420	4.89	5.83
0.0110	0.0166	0.2686	5.98	6.47
0.0130	0.0196	0.2951	7.06	7.12
0.0150	0.0226	0.3450	8.14	8.32
0.0170	0.0257	0.3669	9.24	8.85
0.0200	0.0302	0.3937	10.87	9.48
0.0230	0.0347	0.4378	12.49	10.56
0.0260	0.0393	0.4538	14.12	10.94
0.0300	0.0453	0.4722	16.30	11.38
0.0360	0.0544	0.5095	19.56	12.28
0.0430	0.0649	0.5266	23.35	12.69
0.0530	0.0800	0.5605	28.78	13.51
0.0630	0.0951	0.5812	34.22	14.01
0.0780	0.1178	0.6012	42.36	14.49
0.0980	0.1480	0.6340	53.23	15.28
0.1230	0.1857	0.6576	66.81	15.85
0.1530	0.2310	0.6892	83.11	16.61
0.1880	0.2839	0.7250	102.12	17.47
0.2380	0.3593	0.7645	129.27	18.43
0.2880	0.4348	0.7948	156.43	19.16
0.3380	0.5103	0.8334	183.58	20.08
0.3880	0.5859	0.8660	210.74	20.87
0.4380	0.6613	0.9004	237.89	21.70
0.4880	0.7368	0.9336	265.06	22.50
0.5380	0.8122	0.9568	292.21	23.06
0.5880	0.8877	0.9743	319.37	23.48
0.6380	0.9632	0.9847	346.53	23.73
0.6880	1.0387	0.9956	373.68	23.99
0.7380	1.1142	0.9993	400.84	24.09
0.8130	1.2274	1.0000	441.58	24.10

DATE 81668 RUN NO. 1

N= 2 X= 29.67 IN. UG= 32.04 FT/SEC REDELTA2= 1264.1

CF/2= 0.00203 VWALL/UG= 0.00139 K= 0.142E-05

VWALLPLUS= 0.0441 PPLUS= -0.01557

DEL= 0.741 IN. DELTA2= 0.0777 IN. H= 1.377

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0108	0.2864	5.86	6.23
0.0090	0.0121	0.3081	6.59	6.84
0.0100	0.0135	0.3361	7.32	7.47
0.0120	0.0162	0.3889	8.79	8.64
0.0140	0.0189	0.4266	10.26	9.47
0.0160	0.0216	0.4633	11.72	10.29
0.0180	0.0243	0.4908	13.18	10.90
0.0200	0.0270	0.5083	14.64	11.29
0.0230	0.0310	0.5416	16.84	12.03
0.0260	0.0351	0.5673	19.04	12.60
0.0300	0.0405	0.5862	21.97	13.03
0.0350	0.0472	0.6154	25.63	13.67
0.0410	0.0553	0.6312	30.02	14.02
0.0490	0.0661	0.6567	35.88	14.59
0.0590	0.0796	0.6812	43.21	15.13
0.0720	0.0971	0.7002	52.72	15.55
0.0870	0.1173	0.7187	63.71	15.96
0.1070	0.1443	0.7426	78.35	16.43
0.1270	0.1713	0.7616	93.00	16.92
0.1470	0.1983	0.7758	107.64	17.23
0.1720	0.2320	0.7994	125.95	17.76
0.1970	0.2657	0.8143	144.26	18.08
0.2220	0.2994	0.8276	162.56	18.38
0.2470	0.3332	0.8394	180.87	18.65
0.2720	0.3669	0.8524	199.19	18.93
0.3070	0.4141	0.8676	224.82	19.27
0.3420	0.4613	0.8814	250.44	19.57
0.3820	0.5153	0.8974	279.74	19.93
0.4220	0.5692	0.9095	309.03	20.21
0.4720	0.6367	0.9262	345.64	20.57
0.5470	0.7378	0.9495	400.56	21.10
0.6220	0.8390	0.9706	455.48	21.55
0.6970	0.9401	0.9835	510.40	21.85
0.7720	1.0413	0.9945	565.33	22.09
0.8470	1.1425	0.9978	620.26	22.16
0.9220	1.2436	1.0000	675.18	22.21

DATE 81668 RUN NO. 1

N= 3 X= 37.69 IN. UG= 39.23 FT/SEC REDELTA2= 1224.6

CF/2= 0.00203 VWALL/UG= 0.00203 K= 0.142E-05

VWALLPLUS= 0.0450 PPLUS= -0.01561

DEL= 0.687 IN. DELTA2= 0.0615 IN. H= 1.350

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0087	0.2777	5.38	6.17	1.197
0.0070	0.0102	0.3054	6.27	6.79	1.212
0.0080	0.0116	0.3286	7.17	7.30	1.223
0.0090	0.0131	0.3703	8.06	8.22	1.252
0.0100	0.0145	0.3932	8.96	8.74	1.263
0.0110	0.0160	0.4253	9.86	9.45	1.284
0.0120	0.0175	0.4465	10.75	9.78	1.287
0.0140	0.0204	0.4832	12.54	10.73	1.308
0.0160	0.0233	0.5196	14.34	11.54	1.324
0.0180	0.0262	0.5470	16.13	12.15	1.332
0.0200	0.0291	0.5653	17.92	12.56	1.331
0.0230	0.0335	0.5918	20.62	13.14	1.329
0.0270	0.0393	0.6219	24.20	13.81	1.325
0.0320	0.0466	0.6438	28.68	14.30	1.305
0.0380	0.0553	0.6694	34.06	14.87	1.284
0.0460	0.0669	0.6904	41.23	15.34	1.245
0.0570	0.0829	0.7148	51.08	15.87	1.192
0.0720	0.1048	0.7398	64.53	16.44	1.120
0.0920	0.1339	0.7689	82.46	17.07	1.030
0.1120	0.1630	0.7913	100.38	17.58	0.945
0.1320	0.1921	0.8105	118.31	18.00	0.866
0.1570	0.2284	0.8301	140.71	18.44	0.774
0.1820	0.2648	0.8492	163.12	18.86	0.692
0.2120	0.3085	0.8654	190.01	19.22	0.600
0.2470	0.3594	0.8837	221.37	19.63	0.508
0.2820	0.4103	0.8993	252.74	19.98	0.427
0.3220	0.4685	0.9138	288.59	20.30	0.346
0.3670	0.5340	0.9288	328.93	20.63	0.271
0.4170	0.6067	0.9437	373.74	20.96	0.206
0.4770	0.6940	0.9575	427.52	21.26	0.145
0.5420	0.7886	0.9719	485.77	21.59	0.105
0.6170	0.8977	0.9831	552.99	21.84	0.076
0.6920	1.0068	0.9905	620.21	22.00	0.061
0.7670	1.1160	0.9956	687.43	22.12	0.056
0.8420	1.2251	0.9985	754.65	22.18	0.056
0.9420	1.3706	1.0000	844.28	22.21	0.057

DATE 81668 RUN NO. 1

N= 4 X= 45.64 IN. UG= 51.58 FT/SEC REDELTA2= 1191.4

CF/2= 0.00203 VWALL/UG= 0.00234 K= 0.148E-05

VWALLPLUS= 0.0457 PPLUS= -0.01658

DEL= 0.564 IN. DELTA2= 0.0462 IN. H= 1.357

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0106	0.3168	6.92	7.09	1.215
0.0070	0.0124	0.3443	8.07	7.70	1.226
0.0080	0.0142	0.3893	9.22	8.71	1.256
0.0090	0.0159	0.4306	10.38	9.64	1.283
0.0100	0.0177	0.4673	11.53	10.45	1.305
0.0110	0.0195	0.4829	12.68	10.80	1.306
0.0130	0.0230	0.5292	14.99	11.84	1.326
0.0150	0.0266	0.5611	17.30	12.55	1.332
0.0170	0.0301	0.5860	19.61	13.11	1.333
0.0190	0.0337	0.6036	21.92	13.50	1.326
0.0220	0.0390	0.6296	25.38	14.09	1.318
0.0250	0.0443	0.6448	28.83	14.43	1.301
0.0300	0.0531	0.6684	34.60	14.96	1.272
0.0360	0.0638	0.6914	41.53	15.47	1.234
0.0430	0.0762	0.7124	49.60	15.94	1.190
0.0530	0.0939	0.7340	61.14	16.43	1.123
0.0630	0.1116	0.7550	72.67	16.90	1.062
0.0780	0.1382	0.7799	89.97	17.45	0.974
0.0930	0.1648	0.8019	107.27	17.95	0.894
0.1130	0.2002	0.8280	130.34	18.52	0.799
0.1330	0.2356	0.8502	153.42	19.02	0.716
0.1580	0.2799	0.8709	182.25	19.49	0.622
0.1880	0.3331	0.8921	216.85	19.96	0.526
0.2230	0.3951	0.9118	257.22	20.40	0.434
0.2630	0.4659	0.9297	303.36	20.80	0.349
0.3080	0.5457	0.9464	355.26	21.18	0.278
0.3580	0.6342	0.9587	412.94	21.45	0.215
0.4080	0.7228	0.9708	470.61	21.73	0.177
0.4580	0.8114	0.9789	528.29	21.90	0.149
0.5330	0.9443	0.9872	614.79	22.09	0.124
0.6080	1.0771	0.9938	701.30	22.24	0.117
0.6830	1.2100	0.9982	787.82	22.33	0.119
0.7580	1.3429	0.9995	874.33	22.36	0.121
0.8580	1.5200	1.0000	989.69	22.37	0.122

DATE 81668 RUN NO. 1

N= 5 X= 49.52 IN. UG= 57.39 FT/SEC REDELTA2= 1151.1

CF/2= 0.00203 VWALL/UG= 0.00235 K= 0.148E-05

VWALLPLUS= 0.0459 PPLUS= -0.01654

DEL= 0.464 IN. DELTA2= 0.0383 IN. H= 1.364

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0129	0.3565	8.06	7.98	1.242
0.0070	0.0151	0.3774	9.41	8.44	1.244
0.0080	0.0172	0.4176	10.76	9.34	1.267
0.0090	0.0194	0.4612	12.10	10.32	1.294
0.0100	0.0216	0.4882	13.44	10.93	1.305
0.0120	0.0259	0.5380	16.13	12.04	1.325
0.0140	0.0302	0.5784	18.81	12.94	1.336
0.0170	0.0366	0.6135	22.85	13.72	1.330
0.0210	0.0453	0.6479	28.23	14.50	1.314
0.0260	0.0560	0.6768	34.94	15.15	1.283
0.0320	0.0690	0.7032	43.00	15.74	1.243
0.0390	0.0841	0.7243	52.42	16.21	1.190
0.0490	0.1056	0.7499	65.86	16.78	1.118
0.0590	0.1272	0.7729	79.30	17.30	1.053
0.0740	0.1595	0.7993	99.46	17.89	0.959
0.0890	0.1919	0.8218	119.62	18.39	0.874
0.1090	0.2350	0.8463	146.49	18.94	0.773
0.1340	0.2889	0.8724	180.09	19.52	0.667
0.1590	0.3428	0.8926	213.69	19.97	0.576
0.1890	0.4074	0.9132	254.02	20.43	0.489
0.2190	0.4721	0.9308	294.33	20.83	0.423
0.2590	0.5583	0.9475	348.09	21.20	0.352
0.3090	0.6661	0.9642	415.29	21.58	0.295
0.3590	0.7739	0.9738	482.49	21.79	0.252
0.4090	0.8817	0.9826	549.69	21.99	0.229
0.4690	1.0110	0.9907	630.34	22.17	0.218
0.5390	1.1619	0.9968	724.41	22.31	0.220
0.6140	1.3236	0.9987	825.21	22.35	0.220
0.6890	1.4853	0.9997	926.02	22.37	0.221
0.7640	1.6470	1.0000	1026.82	22.38	0.222

DATE 81668 RUN NO. 1

N= 6 X= 61.77 IN. UG= 74.46 FT/SEC REDELTA2= 2111.8

CF/2= 0.00145 VWALL/UG= 0.00201 K= 0.000E 00

VWALLPLUS= 0.0529 PPLUS= 0.00000

DEL= 0.497 IN. DELTA2= 0.0560 IN. H= 1.457

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0121	0.3289	8.61	8.65
0.0070	0.0141	0.3619	10.04	9.51
0.0080	0.0161	0.3931	11.48	10.33
0.0090	0.0181	0.4147	12.91	10.90
0.0100	0.0201	0.4366	14.35	11.47
0.0120	0.0241	0.4676	17.21	12.29
0.0140	0.0282	0.4868	20.09	12.80
0.0170	0.0342	0.5112	24.39	13.44
0.0200	0.0402	0.5291	28.69	13.91
0.0240	0.0483	0.5484	34.43	14.41
0.0290	0.0584	0.5684	41.60	14.93
0.0360	0.0724	0.5891	51.64	15.49
0.0460	0.0926	0.6124	65.99	16.09
0.0580	0.1167	0.6396	83.21	16.81
0.0710	0.1429	0.6655	101.86	17.49
0.0860	0.1731	0.6900	123.38	18.13
0.1010	0.2032	0.7160	144.90	18.82
0.1160	0.2334	0.7378	166.41	19.40
0.1310	0.2636	0.7598	187.94	19.97
0.1460	0.2938	0.7777	209.45	20.44
0.1660	0.3340	0.8047	238.15	21.15
0.1860	0.3743	0.8288	266.84	21.78
0.2060	0.4145	0.8513	295.53	22.37
0.2260	0.4548	0.8722	324.22	22.92
0.2460	0.4950	0.8886	352.91	23.36
0.2710	0.5453	0.9072	388.79	23.84
0.2960	0.5956	0.9247	424.65	24.30
0.3210	0.6459	0.9406	460.52	24.72
0.3510	0.7063	0.9551	503.55	25.10
0.3860	0.7767	0.9686	553.76	25.46
0.4210	0.8471	0.9774	603.98	25.69
0.4610	0.9276	0.9853	661.36	25.90
0.5110	1.0282	0.9918	733.09	26.07
0.5610	1.1289	0.9951	804.82	26.16
0.6110	1.2295	0.9974	876.56	26.22
0.6860	1.3804	0.9988	984.15	26.25
0.7610	1.5313	0.9996	1091.75	26.27
0.8610	1.7325	1.0000	1235.21	26.28

DATE 81668 RUN NO. 1

N= 7 X= 69.70 IN. UG= 74.63 FT/SEC REDELTA2= 3053.7

CF/2= 0.00120 VWALL/UG= 0.00201 K= 0.000E 00

VWALLPLUS= 0.0582 PPLUS= 0.00000

DEL= 0.624 IN. DELTA2= 0.0809 IN. H= 1.488

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0096	0.2799	7.83	8.10
0.0070	0.0112	0.2994	9.14	8.67
0.0080	0.0128	0.3357	10.45	9.71
0.0090	0.0144	0.3550	11.75	10.28
0.0110	0.0176	0.4000	14.36	11.58
0.0130	0.0208	0.4292	16.97	12.43
0.0160	0.0257	0.4517	20.89	13.08
0.0200	0.0321	0.4765	26.11	13.79
0.0250	0.0401	0.4989	32.64	14.44
0.0300	0.0481	0.5164	39.18	14.95
0.0370	0.0593	0.5349	48.32	15.48
0.0460	0.0737	0.5556	60.08	16.08
0.0560	0.0898	0.5764	73.13	16.68
0.0690	0.1106	0.5977	90.11	17.30
0.0840	0.1347	0.6222	109.70	18.01
0.1040	0.1667	0.6486	135.82	18.77
0.1240	0.1988	0.6731	161.93	19.47
0.1490	0.2389	0.7013	194.59	20.30
0.1740	0.2790	0.7262	227.23	21.02
0.1990	0.3190	0.7503	259.89	21.72
0.2240	0.3591	0.7739	292.53	22.39
0.2490	0.3992	0.7961	325.19	23.04
0.2740	0.4393	0.8186	357.83	23.69
0.3040	0.4874	0.8425	397.01	24.38
0.3340	0.5355	0.8661	436.19	25.07
0.3690	0.5916	0.8882	481.90	25.70
0.4090	0.6557	0.9125	534.14	26.41
0.4490	0.7199	0.9339	586.37	27.03
0.4890	0.7840	0.9541	638.61	27.61
0.5290	0.8481	0.9690	690.85	28.04
0.5740	0.9205	0.9814	749.62	28.40
0.6240	1.0006	0.9900	814.92	28.65
0.6740	1.0806	0.9955	880.22	28.81
0.7490	1.2008	0.9982	978.16	28.89
0.8240	1.3211	0.9998	1076.10	28.94
0.8990	1.4413	1.0000	1174.05	28.94

DATE 81668 RUN NO. 1

M= 8 X= 85.78 IN. UG= 74.61 FT/SEC REDELTA2= 4952.1

CF/2= 0.00100 VWALL/UG= 0.00199 K= 0.000E 00

VWALLPLUS= 0.0628 PPLUS= 0.00000

DEL= 0.941 IN. DELT/2= 0.1311 IN. H= 1.500

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0064	0.2441	7.18	7.71
0.0070	0.0074	0.2625	8.37	8.29
0.0080	0.0085	0.2839	9.57	8.97
0.0090	0.0096	0.3092	10.76	9.76
0.0100	0.0106	0.3263	11.96	10.31
0.0120	0.0127	0.3588	14.35	11.33
0.0140	0.0149	0.3823	16.75	12.38
0.0170	0.0181	0.4064	20.34	12.83
0.0210	0.0223	0.4301	25.12	13.59
0.0270	0.0287	0.4534	32.29	14.33
0.0360	0.0382	0.4786	43.06	15.12
0.0480	0.0510	0.5057	57.41	15.98
0.0630	0.0669	0.5292	75.35	16.72
0.0830	0.0882	0.5582	99.28	17.63
0.1030	0.1094	0.5809	123.19	18.35
0.1280	0.1360	0.6055	153.10	19.12
0.1580	0.1678	0.6303	188.98	19.91
0.1930	0.2050	0.6564	230.85	20.73
0.2330	0.2475	0.6842	278.69	21.61
0.2730	0.2901	0.7123	326.53	22.50
0.3180	0.3378	0.7374	380.35	23.29
0.3680	0.3909	0.7686	440.16	24.28
0.4180	0.4440	0.7957	499.97	25.13
0.4680	0.4971	0.8227	559.77	25.99
0.5180	0.5502	0.8495	619.57	26.84
0.5680	0.6033	0.8721	679.38	27.55
0.6180	0.6564	0.8932	739.19	28.21
0.6680	0.7095	0.9140	798.99	28.88
0.7180	0.7626	0.9335	858.79	29.48
0.7680	0.8158	0.9511	918.60	30.05
0.8180	0.8689	0.9663	978.41	30.53
0.8680	0.9220	0.9783	1038.21	30.90
0.9430	1.0016	0.9902	1127.92	31.28
1.0180	1.0813	0.9966	1217.62	31.48
1.0930	1.1610	0.9982	1307.33	31.53
1.1930	1.2672	0.9996	1426.93	31.58
1.2930	1.3734	0.9998	1546.55	31.59
1.3930	1.4796	1.0000	1666.15	31.59

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	$F \times 10^3$	$K \times 10^6$	RE_{δ_2}	H	$K(H+1)RE_{\delta_2}-F$	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
41268/4	±0.02	±0.10	±0.03	±8%	±1.5%	±0.03	±0.35	±0.40	±0.10		±6.0
M = 1	29.90	41.00	4.01	0.0	3151	1.569	--	--	0.86	0.90	5.5
M = 2	53.86	50.34	4.02	0.572	3710	1.392	1.06	1.13	0.96	1.06	2.0
M = 3	66.83	61.93	3.95	0.566	3738	1.367	1.05	1.01	0.92	1.05	3.1
M = 4	77.79	76.98	4.03	0.586	3720	1.357	1.11	1.05	0.77	1.07	0.5
40268/4	±0.02	±0.12	±0.03	±13%	±2.7%	±0.05	±0.60	±0.70	±0.15		±7.0
M = 1	29.90	31.02	3.91	0.0	2404	1.546	--	--	1.12	1.04	7.5
M = 2	53.86	38.19	3.91	0.780	2980	1.398	1.67	1.64	1.32	1.19	7.0
M = 3	66.83	47.04	3.83	0.771	2971	1.365	1.59	1.54	1.23	1.18	8.5
M = 4	77.79	58.40	3.93	0.771	2955	1.358	1.45	1.39	1.04	1.16	0.1
82068/8	±0.02	±0.10	±0.03	±10%	±3.5%	±0.05	±0.50	±0.70	±0.20		±5.5
M = 1	13.78	25.60	3.92	0.0	1468	1.635	--	--	1.24	1.11	-3.4
M = 2	29.67	31.28	3.95	1.41	1661	1.420	1.72	1.35	1.75	1.48	3.6
M = 3	37.69	38.24	3.98	1.39	1604	1.388	1.35	1.42	1.61	1.45	3.2
M = 4	45.64	49.18	4.03	1.45	1619	1.385	1.56	1.28	1.25	1.38	2.4
M = 5	49.52	57.04	4.06	1.44	1588	1.372	1.36	1.04	1.33	1.45	1.0
M = 6	61.77	70.48	3.98	0.0	2952	1.563	--	--	0.61	0.80	3.1
M = 7	69.70	70.30	3.98	0.0	4356	1.611	--	--	0.54	0.68	1.3
M = 8	85.78	70.31	3.99	0.0	7197	1.648	--	--	0.43	0.53	5.0

SETUP DATA

VWALL/UG= 0.004

RUN:	41268-1	40768-1	82068-1
PBARO (IN. HG) =	29.8[illegible]	29.87	29.87
TAMBIENT (DEG-F) =	74.9	71.0	76.1
RELATIVE HUMIDITY =	0.45	0.45	0.4[illegible]
TGAS (DEG-F) =	74.73	71.46	67.24
GAS DENSITY (LBM/FT3) =	0.0740	0.0743	0.0746
GAS VISCOSITY (FT2/SEC) =	0.166E-03	0.165E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	41.16	0.01220	31.05	0.00897	25.77	0.00744
3.953	41.16		31.05		25.77	
5.953	41.16	0.01215	31.05	0.00891	25.73	0.00751
7.961	41.14		31.05		25.64	
9.969	41.11	0.01212	31.03	0.00904	25.62	0.00746
11.953	41.11		31.05		25.60	
13.937	41.14	0.01210	31.05	0.00900	25.60	0.00749
15.945	41.11		31.05		25.62	
17.953	41.06	0.01214	31.05	0.00902	25.82	0.00752
19.922	41.03		31.02		26.18	
21.938	40.95	0.01213	30.97	0.00900	26.79	0.00778
23.954	40.78		30.90		27.65	
25.962	40.84	0.01209	30.96	0.00904	28.79	0.00846
27.962	40.85		30.99		29.93	
29.978	41.00	0.01218	31.02	0.00930	31.26	0.00921
31.939	41.06		31.05		32.75	
33.955	41.22	0.01220	31.12	0.00904	34.52	0.01034
35.955	41.47		31.20		36.35	
37.971	41.93	0.01[illegible]32	31.69	0.00907	38.27	0.01135
39.987	42.59		32.19		40.54	
41.963	43.36	0.01283	32.74	0.00942	43.35	0.01232
43.963	44.33		33.42		46.00	
45.963	45.34	0.01338	34.22	0.00986	49.32	0.01477
47.979	46.40		35.09		5[illegible].21	
49.979	47.74	0.01415	36.04	0.01043	57.78	0.01727
51.979	49.14		37.09		62.97	
53.995	50.57	0.01497	38.20	0.01107	68.31	0.02[illegible]4
55.971	52.06		39.38		69.96	
57.971	53.64	0.01583	[illegible]0.54	0.01181	69.93	0.02086
59.955	55.38		41.82		69.90	
61.979	57.23	0.01694	43.23	0.01244	69.75	0.02089
63.971	59.17		44.71		69.69	
65.979	61.14	0.01811	46.22	0.01336	69.64	0.02076
67.963	63.34		47.99		69.64	
69.971	65.76	0.01953	49.86	0.01447	69.56	0.02084
71.979	68.39		51.76		69.46	
73.963	71.18	0.02112	53.92	0.01558	69.46	0.02088
75.939	74.08		56.09		69.36	
77.947	77.49	0.02294	58.70	0.01700	69.37	0.02075
79.[illegible]39	81.13		61.46		69.33	
81.[illegible]31	85.24	0.02529	64.54	0.018[illegible]7	69.35	0.02091
83.962	89.69		67.85		69.33	
85.931	94.39	0.02776	71.37	0.0205[illegible]	69.28	[illegible]2088
87.915	99.54		75.28		69.24	
89.939	105.36	0.03102	79.48	0.02289	69.17	0.02070
91.931	111.65		84.11		69.17	
93.947	118.77	0.03470	89.40	0.02598	69.14	0.02072

DATE 41268 RUN NO. 1

N= 1 X= 25.90 IN. UG= 41.00 FT/SEC REDELTA2= 3151.3

CF/2= 0.00090 VWALL/UG= 0.00401 K= [illegible]

VWALLPLUS= 0.1340 PPLUS= 0.00300

DEL= 1.099 IN. DELTA2= 0.1533 IN. H= 1.569

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0064	0.1741	4.31	5.81
0.0080	0.0073	0.1950	4.93	6.31
0.0090	0.0082	0.2225	5.54	7.09
0.0100	0.0091	0.2278	6.16	7.60
0.0120	0.0109	0.2635	7.39	8.79
0.0140	0.0127	0.2879	8.62	9.61
0.0170	0.0155	0.3148	10.47	10.51
0.0200	0.0187	0.3395	12.31	11.33
0.0250	0.0227	0.3695	15.39	12.33
0.0310	0.0282	0.3952	19.09	13.12
0.0380	0.0344	0.4252	23.40	14.19
0.0480	0.0437	0.4452	29.55	14.86
0.0630	0.0573	0.4716	38.79	15.74
0.0780	0.0710	0.4938	48.03	16.48
0.0980	0.0892	0.5202	60.34	17.36
0.1230	0.1119	0.5478	75.73	18.28
0.1480	0.1347	0.5736	91.13	19.12
0.1830	0.1665	0.6026	112.65	20.11
0.2180	0.1984	0.6277	134.23	20.95
0.2530	0.2302	0.6528	155.78	21.79
0.2930	0.2666	0.6790	180.41	22.66
0.3430	0.3121	0.7118	211.19	23.76
0.3930	0.3576	0.7340	241.98	24.50
0.4480	0.4076	0.7679	275.84	25.63
0.4980	0.4531	0.7971	306.63	26.60
0.5480	0.4986	0.8186	337.41	27.32
0.5980	0.5441	0.8444	368.20	28.18
0.6480	0.5896	0.8664	398.98	28.92
0.7080	0.6442	0.8923	435.93	29.78
0.7730	0.7033	0.9153	475.95	30.55
0.8480	0.7716	0.9434	522.13	31.49
0.9230	0.8398	0.9631	568.31	32.14
0.9980	0.9081	0.9783	614.49	32.65
1.0480	0.9535	0.9845	645.27	32.86
1.1230	1.0218	0.9926	691.45	33.13
1.1980	1.0900	0.9966	737.63	33.26
1.2730	1.1583	0.9987	783.81	33.33
1.3730	1.2493	1.0000	845.39	33.38

DATE 41268 RUN NO. 1

N= 2 X= 53.86 IN. UG= 50.34 FT/SEC REDELTA2= 3779.5

CF/2= 0.00106 VWALL/UG= 0.00402 K= 0.572E-06

VWALLPLUS= 0.1234 PPLUS= -0.01656

DEL= 1.316 IN. DELTA2= 0.1471 IN. H= 1.392

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0053	0.2458	5.74	7.55
0.0080	0.0061	0.2700	6.57	8.29
0.0090	0.0068	0.2921	7.39	8.96
0.0110	0.0084	0.3331	9.04	10.24
0.0130	0.0099	0.3652	10.68	11.21
0.0150	0.0114	0.3842	12.32	11.79
0.0180	0.0137	0.4155	14.79	12.75
0.0210	0.0160	0.4393	17.25	13.49
0.0250	0.0190	0.4622	20.54	14.18
0.0300	0.0228	0.4809	24.64	14.76
0.0380	0.0289	0.5096	31.22	15.65
0.0480	0.0365	0.5335	39.43	16.38
0.0630	0.0479	0.5643	51.75	17.33
0.0780	0.0593	0.5920	64.07	18.17
0.0930	0.0707	0.6112	76.39	18.77
0.1130	0.0859	0.6383	92.82	19.60
0.1330	0.1011	0.6622	109.25	20.33
0.1580	0.1201	0.6814	129.79	20.92
0.1930	0.1467	0.7121	158.53	21.86
0.2230	0.1695	0.7281	183.17	22.36
0.2630	0.1999	0.7510	216.03	23.06
0.3030	0.2303	0.7720	248.89	23.70
0.3430	0.2607	0.7895	281.74	24.19
0.3930	0.2987	0.8064	322.81	24.76
0.4430	0.3367	0.8223	363.88	25.24
0.4930	0.3747	0.8435	404.95	25.91
0.5430	0.4127	0.8531	446.02	26.20
0.6180	0.4697	0.8727	507.63	26.80
0.6930	0.5267	0.8923	569.23	27.40
0.7680	0.5837	0.9096	630.83	27.92
0.8430	0.6407	0.9261	692.44	28.43
0.9180	0.6977	0.9413	754.05	28.91
0.9930	0.7547	0.9517	815.65	29.22
1.0930	0.8307	0.9684	897.79	29.73
1.1930	0.9067	0.9802	979.94	30.10
1.2930	0.9827	0.9884	1062.08	30.34
1.3930	1.0587	0.9955	1144.21	30.57
1.4930	1.1347	0.9987	1226.35	30.66
1.5930	1.2107	1.0000	1308.49	30.70

DATE 41268 RUN NO. 1

N= 3 X= 66.83 IN. UG= 61.93 FT/SEC REDELTA2= 3738.3

CF/2= 0.00105 VWALL/UG= 0.00395 K= 0.566E-06

VWALLPLUS= 0.1220 PPLUS= -0.01662

DEL= 1.229 IN. DELTA2= 0.1206 IN. H= 1.367

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0049	0.2567	6.02	7.92	1.875
0.0070	0.0057	0.2776	7.04	8.57	1.933
0.0080	0.0065	0.2990	8.04	9.23	1.998
0.0090	0.0073	0.3272	9.05	10.10	2.089
0.0100	0.0081	0.3473	10.05	10.71	2.149
0.0110	0.0090	0.3646	11.05	11.25	2.201
0.0120	0.0098	0.3858	12.06	11.90	2.265
0.0130	0.0106	0.3993	13.06	12.32	2.303
0.0150	0.0122	0.4159	15.07	12.83	2.327
0.0180	0.0146	0.4446	18.08	13.72	2.405
0.0210	0.0171	0.4665	21.11	14.39	2.447
0.0250	0.0203	0.4887	25.12	15.08	2.480
0.0300	0.0244	0.5111	30.14	15.77	2.501
0.0360	0.0293	0.5303	36.18	16.37	2.501
0.0440	0.0358	0.5520	44.21	17.03	2.488
0.0530	0.0431	0.5734	53.26	17.70	2.467
0.0650	0.0529	0.5980	65.31	18.45	2.427
0.0770	0.0627	0.6193	77.37	19.11	2.382
0.0900	0.0732	0.6399	90.44	19.75	2.329
0.1050	0.0854	0.6624	105.51	20.44	2.269
0.1200	0.0976	0.6808	120.58	21.01	2.202
0.1400	0.1139	0.7050	140.68	21.76	2.127
0.1600	0.1302	0.7240	160.77	22.34	2.028
0.1850	0.1505	0.7468	185.89	23.04	1.923
0.2100	0.1709	0.7639	211.02	23.57	1.809
0.2400	0.1953	0.7829	241.16	24.16	1.680
0.2700	0.2197	0.8004	271.31	24.69	1.559
0.3050	0.2482	0.8196	306.47	25.29	1.432
0.3400	0.2767	0.8317	341.64	25.67	1.294
0.3800	0.3092	0.8506	381.84	26.25	1.170
0.4200	0.3417	0.8616	422.03	26.59	1.035
0.4550	0.3702	0.8738	457.20	26.96	0.936
0.4900	0.3987	0.8839	492.38	27.27	0.842
0.5400	0.4394	0.8957	542.61	27.64	0.715
0.5900	0.4801	0.9075	592.85	28.01	0.606
0.6500	0.5289	0.9204	653.15	28.40	0.490
0.7150	0.5818	0.9312	718.46	28.73	0.377
0.7900	0.6428	0.9434	793.82	29.11	0.274
0.8650	0.7038	0.9552	869.18	29.48	0.198
0.9400	0.7649	0.9635	944.55	29.73	0.130
1.0150	0.8259	0.9735	1019.91	30.04	0.093
1.0900	0.8869	0.9804	1095.27	30.25	0.063
1.1900	0.9683	0.9876	1195.76	30.47	0.039
1.2900	1.0497	0.9929	1296.24	30.66	[illegible]
1.3900	1.1310	0.9973	1396.72	30.78	[illegible]
1.4900	1.2124	0.9991	1497.21	30.83	[illegible]
1.5900	1.2938	1.0000	1597.69	30.86	[illegible]

DATE 41268 RUN NO. 1

N= 4 X= 77.79 IN. UG= 76.93 FT/SEC REDELTA2= 3770.3

CF/2= 0.00107 VWALL/UG= 0.00403 K= 0.586E-06

VWALLPLUS= 0.1236 PPLUS= -0.01697

DEL= 1.060 IN. DELTA2= 0.0966 IN. H= 1.357

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0057	0.2932	7.54	8.98	1.988
0.0070	0.0066	0.3158	8.79	9.68	2.056
0.0080	0.0075	0.3391	10.05	10.39	2.125
0.0090	0.0085	0.3682	11.31	11.28	2.216
0.0100	0.0094	0.3893	12.56	11.93	2.278
0.0110	0.0104	0.4093	13.82	12.54	2.336
0.0130	0.0123	0.4399	16.33	13.48	2.417
0.0150	0.0142	0.4585	18.85	14.05	2.454
0.0180	0.0170	0.4852	22.62	14.87	2.506
0.0210	0.0198	0.5022	26.38	15.39	2.522
0.0250	0.0236	0.5234	31.41	16.04	2.543
0.0290	0.0274	0.5381	36.44	16.49	2.535
0.0360	0.0340	0.5630	45.22	17.25	2.526
0.0440	0.0415	0.5849	55.27	17.92	2.495
0.0560	0.0528	0.6142	70.35	18.82	2.444
0.0690	0.0651	0.6394	86.69	19.60	2.373
0.0810	0.0764	0.6614	101.76	20.27	2.310
0.0910	0.0859	0.6779	114.31	20.78	2.256
0.1010	0.0953	0.6943	126.88	21.28	2.206
0.1110	0.1047	0.7060	139.44	21.63	2.142
0.1240	0.1170	0.7269	155.78	22.29	2.064
0.1370	0.1293	0.7361	172.11	22.56	1.993
0.1510	0.1425	0.7515	189.69	23.03	1.919
0.1640	0.1547	0.7628	206.02	23.37	1.844
0.1790	0.1689	0.7764	224.87	23.80	1.768
0.1940	0.1830	0.7898	243.72	24.19	1.694
0.2090	0.1972	0.8069	262.55	24.54	1.622
0.2290	0.2161	0.8138	287.68	24.94	1.524
0.2490	0.2349	0.8236	312.81	25.24	1.422
0.2740	0.2585	0.8401	344.21	25.74	1.322
0.2990	0.2821	0.8536	375.62	26.16	1.226
0.3240	0.3057	0.8634	407.02	26.46	1.125
0.3540	0.3340	0.8756	444.71	26.84	1.018
0.3940	0.3718	0.8859	494.96	27.27	0.886
0.4340	0.4095	0.9026	545.21	27.66	0.769
0.4690	0.4425	0.9127	589.19	27.97	0.678
0.5190	0.4897	0.9247	651.99	28.34	0.561
0.5690	0.5369	0.9338	714.80	28.62	0.453
0.6440	0.6075	0.9485	809.02	29.05	0.327
0.7190	0.6784	0.9580	903.24	29.36	0.222
0.8190	0.7728	0.9718	1028.86	29.78	0.132
0.9190	0.8671	0.9812	1154.49	30.03	0.066
1.0190	0.9615	0.9881	1280.11	30.28	0.033
1.1190	1.0558	0.9927	1405.73	30.42	0.012
1.2190	1.1502	0.9966	1531.36	30.54	[illegible]
1.3190	1.2445	0.9980	1655.98	30.61	[illegible]
1.4190	1.3389	[illegible]	1782.61	30.63	[illegible]
1.5190	1.4332	[illegible]	1909.23	30.64	[illegible]

DATE 42268 RUN NO. 1

N= 1 X= 29.90 IN. UG= 31.02 FT/SEC REDELTA2= 2403.7

CF/2= 0.00104 VWALL/UG= 0.00391 K= 0.000E 00

VWALLPLUS= 0.1214 PPLUS= 0.00000

DEL= 1.150 IN. DELTA2= 0.1534 IN. H= 1.546

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0052	0.1154	3.03	3.59
0.0070	0.0061	0.1653	3.53	5.13
0.0080	0.0070	0.1854	4.04	5.75
0.0100	0.0087	0.2091	5.05	6.50
0.0130	0.0113	0.2547	6.56	7.90
0.0170	0.0148	0.3089	8.58	9.59
0.0210	0.0183	0.3414	10.60	10.60
0.0260	0.0226	0.3742	13.12	11.62
0.0320	0.0278	0.4073	16.15	12.65
0.0380	0.0330	0.4270	19.18	13.26
0.0460	0.0400	0.4485	23.21	13.92
0.0580	0.0504	0.4785	29.27	14.86
0.0680	0.0591	0.4905	34.31	15.23
0.0830	0.0722	0.5183	41.88	16.09
0.0980	0.0852	0.5339	49.46	16.58
0.1130	0.0983	0.5574	57.03	17.30
0.1380	0.1200	0.5760	69.64	17.89
0.1730	0.1504	0.6075	87.30	18.87
0.2130	0.1852	0.6430	107.49	19.97
0.2480	0.2156	0.6610	125.16	20.52
0.2880	0.2504	0.6836	145.34	21.22
0.3380	0.2939	0.7169	170.58	22.26
0.3880	0.3374	0.7457	195.80	23.15
0.4380	0.3808	0.7749	221.04	24.06
0.4880	0.4243	0.8016	246.27	24.89
0.5380	0.4678	0.8174	271.50	25.39
0.5880	0.5113	0.8400	296.74	26.08
0.6380	0.5547	0.8620	321.97	26.76
0.6880	0.5982	0.8807	347.20	27.34
0.7380	0.6417	0.8991	372.44	27.92
0.7880	0.6851	0.9197	397.67	28.55
0.8380	0.7286	0.9385	422.91	29.14
0.8880	0.7721	0.9509	448.13	29.52
0.9380	0.8156	0.9655	473.36	29.98
0.9880	0.8590	0.9716	498.60	30.17
1.0630	0.9243	0.9835	536.44	30.53
1.1380	0.9895	0.9894	574.30	30.72
1.2380	1.0764	0.9941	624.77	30.87
1.4380	1.2503	1.0000	725.69	31.05

DATE 43268 RUN NO. 1

N= 2 X= 53.86 IN. UG= 38.19 FT/SEC REDELTA2= 2980.3

CF/2= 0.00119 VWALL/UG= 0.00391 K= 0.789E-06

VWALLPLUS= 0.1133 PPLUS= -0.01902

DEL= 1.353 IN. DELTA2= 0.1545 IN. H= 1.398

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0044	0.1897	3.99	5.51
0.0070	0.0052	0.2200	4.66	6.38
0.0080	0.0059	0.2356	5.32	6.83
0.0100	0.0074	0.2782	6.65	8.01
0.0120	0.0089	0.3055	7.98	8.56
0.0140	0.0103	.3415	9.31	9.90
0.0160	0.0118	0.3613	10.64	10.47
0.0200	0.0148	0.4035	13.30	11.70
0.0240	0.0177	0.4330	15.96	12.55
0.0290	0.0214	0.4672	19.28	13.55
0.0340	0.0251	0.4898	22.61	14.21
0.0390	0.0288	0.5053	25.93	14.65
0.0490	0.0362	0.5251	32.59	15.34
0.0640	0.0473	0.5630	42.56	16.33
0.0790	0.0584	0.5897	52.53	17.11
0.0940	0.0695	0.6103	62.51	17.70
0.1090	0.0806	0.6290	72.48	18.24
0.1290	0.0954	0.6510	85.78	18.90
0.1490	0.1101	0.6705	99.08	19.44
0.1740	0.1286	0.6909	115.70	20.03
0.1990	0.1471	0.7041	132.33	20.42
0.2240	0.1656	0.7193	148.95	20.86
0.2640	0.1951	0.7446	175.55	21.59
0.3040	0.2247	0.7630	202.15	22.13
0.3490	0.2580	0.7820	232.08	22.68
0.3990	0.2949	0.8005	265.32	23.22
0.4490	0.3319	0.8176	298.57	23.72
0.4990	0.3688	0.8326	331.82	24.14
0.5740	0.4243	0.8509	381.69	24.67
0.6490	0.4797	0.8724	431.56	25.30
0.7240	0.5352	0.8899	481.44	25.81
0.7990	0.5906	0.9067	531.31	26.29
0.8740	0.6460	0.9222	581.18	26.74
0.9740	0.7199	0.9420	647.67	27.32
1.0740	0.7939	0.9583	714.17	27.79
1.1740	0.8678	0.9734	780.67	28.23
1.2740	0.9417	0.9845	847.16	28.56
1.3740	1.0156	0.9915	913.66	28.76
1.4740	1.0895	0.9961	980.16	28.88
1.5740	1.1634	0.9977	1046.65	28.94
1.6740	1.2374	1.0000	1113.15	29.00

DATE 40268 RUN NO. 1

N= 3 X= 66.83 IN. UG= 47.04 FT/SEC REDELTA2= 2971.3

CF/2= 0.00118 VWALL/UG= 0.00383 K= 0.771E-06

VWALLPLUS= 0.1116 PPLUS= -0.01913

DEL= 1.263 IN. DELTA2= 0.1251 IN. H= 1.365

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0047	0.2359	4.89	6.89	1.679
0.0070	0.0055	0.2586	5.70	7.55	1.737
0.0080	0.0063	0.2885	6.52	8.42	1.819
0.0090	0.0071	0.3072	7.33	8.95	1.864
0.0110	0.0087	0.3431	8.96	10.00	1.954
0.0130	0.0103	0.3756	10.58	10.96	2.034
0.0150	0.0119	0.4018	12.21	11.71	2.091
0.0180	0.0142	0.4439	14.65	12.94	2.190
0.0210	0.0166	0.4651	17.10	13.56	2.222
0.0240	0.0190	0.4812	19.54	14.03	2.238
0.0290	0.0230	0.5059	23.61	14.76	2.261
0.0360	0.0285	0.5314	29.32	15.50	2.264
0.0440	0.0348	0.5539	35.82	16.15	2.249
0.0540	0.0427	0.5799	43.97	16.91	2.228
0.0640	0.0507	0.5980	52.11	17.44	2.186
0.0790	0.0625	0.6181	64.33	18.02	2.104
0.0990	0.0784	0.6532	80.61	19.05	2.033
0.1190	0.0942	0.6762	96.89	19.72	1.935
0.1390	0.1100	0.7013	113.17	20.46	1.854
0.1590	0.1259	0.7199	129.47	20.99	1.760
0.1790	0.1417	0.7380	145.75	21.53	1.675
0.1990	0.1575	0.7501	162.03	21.88	1.575
0.2240	0.1773	0.7703	182.39	22.46	1.477
0.2490	0.1971	0.7847	202.75	22.89	1.370
0.2840	0.2248	0.8014	231.25	23.37	1.224
0.3240	0.2565	0.8202	263.81	23.92	1.073
0.3740	0.2960	0.8446	304.53	24.63	0.915
0.4240	0.3356	0.8601	345.24	25.09	0.755
0.4740	0.3752	0.8753	385.95	25.53	0.614
0.5340	0.4227	0.8880	434.81	25.89	0.447
0.5990	0.4741	0.9028	487.73	26.32	0.297
0.6740	0.5335	0.9195	548.80	26.82	0.157
0.7490	0.5929	0.9316	609.86	27.17	0.031
0.8490	0.6720	0.9478	691.29	27.65	-0.094
0.9490	0.7512	0.9617	772.71	28.05	-0.183
1.0490	0.8303	0.9732	854.14	28.38	-0.243
1.1990	0.9491	0.9867	976.27	28.78	-0.287
1.3490	1.0678	0.9944	1098.41	29.00	-0.303
1.4990	1.1865	0.9975	1220.54	29.10	-0.310
1.6490	1.3052	0.9990	1342.68	29.14	-0.313
1.7990	1.4240	1.0000	1464.82	29.17	-0.311

DATE 43268 RUN NO. 1

N= 4 X= 77.79 IN. UG= 58.40 FT/SEC REDELTA2= 2955.4

CF/2= 0.00116 VWALL/UG= 0.00393 K= 0.771E-06

VWALLPLUS= 0.1151 PPLUS= -0.01944

DEL= 1.098 IN. DELTA2= 0.1093 IN. H= 1.358

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0055	0.2681	6.03	7.86	1.785
0.0070	0.0064	0.2852	7.03	8.36	1.831
0.0080	0.0073	0.3128	8.04	9.17	1.906
0.0090	0.0082	0.3401	9.05	9.97	1.981
0.0110	0.0100	0.3856	11.05	11.31	2.102
0.0130	0.0119	0.4200	13.06	12.31	2.184
0.0150	0.0137	0.4429	15.08	12.98	2.229
0.0170	0.0155	0.4662	17.09	13.66	2.276
0.0190	0.0173	0.4815	19.09	14.12	2.299
0.0220	0.0200	0.5055	22.11	14.82	2.336
0.0250	0.0228	0.5184	25.12	15.20	2.336
0.0300	0.0273	0.5433	30.15	15.93	2.350
0.0350	0.0319	0.5577	35.17	16.35	2.330
0.0410	0.0374	0.5775	41.20	16.93	2.318
0.0480	0.0437	0.5943	48.23	17.42	2.285
0.0560	0.0510	0.6119	56.27	17.94	2.245
0.0660	0.0601	0.6341	66.33	18.59	2.201
0.0760	0.0692	0.6536	76.37	19.16	2.153
0.0860	0.0783	0.6695	86.42	19.63	2.097
0.0960	0.0875	0.6842	96.47	20.06	2.041
0.1110	0.1011	0.7060	111.54	20.70	1.964
0.1260	0.1148	0.7245	126.62	21.24	1.884
0.1410	0.1285	0.7398	141.69	21.69	1.805
0.1560	0.1421	0.7530	156.77	22.08	1.716
0.1760	0.1603	0.7678	176.86	22.51	1.602
0.2010	0.1831	0.7856	201.98	23.03	1.469
0.2260	0.2059	0.8014	227.11	23.50	1.343
0.2510	0.2287	0.8202	252.23	24.04	1.245
0.2760	0.2514	0.8337	277.35	24.44	1.133
0.3010	0.2742	0.8463	302.48	24.81	1.033
0.3310	0.3016	0.8571	332.62	25.13	0.913
0.3660	0.3334	0.8732	367.79	25.60	0.794
0.4010	0.3653	0.8863	402.96	25.98	0.685
0.4360	0.3972	0.8970	438.13	26.30	0.584
0.4860	0.4428	0.9116	488.38	26.73	0.458
0.5360	0.4883	0.9228	538.62	27.05	0.342
0.6110	0.5566	0.9366	613.99	27.46	0.194
0.6860	0.6250	0.9499	689.35	27.85	0.081
0.7860	0.7161	0.9644	789.85	28.27	-0.033
0.8860	0.8072	0.9753	890.34	28.59	-0.105
0.9860	0.8983	0.9840	990.82	28.85	-0.150
1.1360	1.0349	0.9920	1141.56	29.09	-0.188
1.2860	1.1716	0.9977	1292.29	29.25	-0.197
1.4360	1.3082	1.0000	1443.03	29.32	-0.194

DATE 82068 RUN NO. 1

N= 1 X= 13.78 IN. UG= 25.60 FT/SEC REDELTA2= 14[illegible].5

CF/2= 0.00111 VWALL/UG= 0.00392 K= 0.000E 00

VWALLPLUS= 0.1179 PPLUS= 0.00000

DEL= 0.780 IN. DELTA2= 0.1124 IN. H= 1.635

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0077	0.1150	2.61	3.57
0.0070	0.0090	0.1299	3.04	3.91
0.0080	0.0103	0.1470	3.47	4.42
0.0090	0.0115	0.1726	3.92	5.18
0.0100	0.0128	0.1914	4.35	5.75
0.0120	0.0154	0.2391	5.22	7.19
0.0140	0.0179	0.2597	6.09	7.80
0.0170	0.0218	0.2849	7.39	8.56
0.0210	0.0269	0.3368	9.13	10.12
0.0250	0.0320	0.3642	10.87	10.94
0.0290	0.0372	0.3780	12.61	11.36
0.0350	0.0449	0.4086	15.22	12.29
0.0430	0.0551	0.4432	18.69	13.32
0.0510	0.0654	0.4585	22.18	13.78
0.0630	0.0807	0.4889	27.40	14.70
0.0760	0.0974	0.5128	33.04	15.41
0.0910	0.1166	0.5293	39.57	15.91
0.1110	0.1423	0.5573	48.26	16.75
0.1360	0.1743	0.5871	59.14	17.64
0.1660	0.2128	0.6183	72.18	18.58
0.2010	0.2576	0.6453	87.40	19.39
0.2410	0.3089	0.6863	104.80	20.63
0.2810	0.3601	0.7188	122.19	21.60
0.3260	0.4178	0.7480	141.75	22.48
0.3760	0.4819	0.7881	163.49	23.69
0.4260	0.5460	0.8283	185.23	24.89
0.4760	0.6101	0.8645	206.98	25.98
0.5260	0.6741	0.8975	228.72	26.97
0.5760	0.7382	0.9274	250.46	27.87
0.6260	0.8023	0.9474	272.19	28.47
0.6760	0.8664	0.9734	293.94	29.25
0.7260	0.9305	0.9821	315.68	29.51
0.7760	0.9946	0.9897	337.42	29.74
0.8510	1.0907	0.9949	370.03	29.90
0.9260	1.1868	0.9983	402.64	30.00
1.0010	1.2829	1.0000	435.26	30.05

DATE 82068 RUN NO. 1

N= 2 X= 25.67 IN. UG= 31.28 FT/SEC REDELTA2= 1661.4

CF/2= 0.00148 VWALL/UG= 0.00395 K= 0.141E-05

VWALLPLUS= 0.1027 PPLUS= -0.02481

DEL= 0.857 IN. DELTA2= 0.1341 IN. H= 1.420

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0070	0.1950	3.68	5.07
0.0070	0.0082	0.2355	4.30	6.13
0.0080	0.0093	0.2709	4.92	7.05
0.0090	0.0105	0.2842	5.52	7.39
0.0110	0.0128	0.3185	6.75	8.28
0.0130	0.0152	0.3527	7.98	9.17
0.0150	0.0175	0.3809	9.20	9.91
0.0180	0.0210	0.4183	11.05	10.88
0.0210	0.0245	0.4523	12.89	11.76
0.0240	0.0280	0.4745	14.74	12.34
0.0280	0.0327	0.5044	17.19	13.12
0.0320	0.0373	0.5182	19.64	13.48
0.0370	0.0432	0.5461	22.72	14.20
0.0420	0.0490	0.5586	25.79	14.53
0.0490	0.0572	0.5865	30.08	15.24
0.0570	0.0665	0.5981	34.99	15.55
0.0690	0.0805	0.6243	42.36	16.23
0.0810	0.0945	0.6369	49.73	16.57
0.0960	0.1120	0.6616	58.93	17.21
0.1160	0.1354	0.6803	71.22	17.70
0.1410	0.1645	0.7073	86.56	18.40
0.1660	0.1937	0.7321	101.91	19.04
0.1960	0.2287	0.7521	120.33	19.56
0.2310	0.2696	0.7696	141.82	20.02
0.2710	0.3162	0.7935	166.37	20.63
0.3160	0.3688	0.8163	194.00	21.23
0.3660	0.4271	0.8397	224.69	21.84
0.4160	0.4855	0.8572	255.38	22.29
0.4910	0.5730	0.8874	301.43	23.07
0.5660	0.6605	0.9128	347.47	23.73
0.6410	0.7480	0.9387	393.52	24.41
0.7160	0.8355	0.9580	439.56	24.92
0.7910	0.9231	0.9757	485.61	25.37
0.8660	1.0106	0.9920	531.65	25.80
0.9410	1.0981	0.9977	577.70	25.95
1.0410	1.2148	0.9993	639.08	25.99
1.1410	1.3315	1.0000	700.48	26.00

DATE 82068 RUN NO. 1

N= 3 X= 37.69 IN. UG= 38.24 FT/SEC REDELTA2= 1674.3

CF/2= 0.00145 VWALL/UG= 0.00399 K= 0.139E-05

VWALLPLUS= 0.1048 PPLUS= -0.02524

DEL= 0.817 IN. DELTA2= 0.0922 IN. H= 1.388

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0073	0.2375	4.45	6.25	1.545
0.0070	0.0086	0.2668	5.20	7.01	1.606
0.0080	0.0098	0.2847	5.94	7.48	1.638
0.0090	0.0110	0.3193	6.69	8.39	1.717
0.0100	0.0122	0.3376	7.43	8.88	1.751
0.0120	0.0147	0.3813	8.91	10.02	1.838
0.0140	0.0171	0.4177	10.39	10.98	1.907
0.0160	0.0195	0.4461	11.88	11.72	1.953
0.0180	0.0220	0.4711	13.36	12.37	1.992
0.0200	0.0245	0.4856	14.85	12.76	2.004
0.0230	0.0282	0.5131	17.09	13.48	2.037
0.0260	0.0318	0.5350	19.31	14.06	2.056
0.0290	0.0355	0.5477	21.53	14.39	2.051
0.0330	0.0404	0.5696	24.50	14.97	2.060
0.0380	0.0465	0.5927	28.22	15.52	2.055
0.0450	0.0551	0.6111	33.41	16.05	2.027
0.0540	0.0661	0.6337	[illegible]	16.66	1.987
0.0650	0.0796	0.6575	48.26	17.27	1.931
0.0770	0.0942	0.6742	57.17	17.72	1.852
0.0920	0.1126	0.7009	68.31	18.42	1.776
0.1090	0.1334	0.7245	80.93	19.04	1.683
0.1270	0.1554	0.7433	94.29	19.53	1.578
0.1470	0.1799	0.7638	109.14	20.07	1.472
0.1720	0.2105	0.7863	127.71	20.66	1.345
0.1970	0.2411	0.8075	146.26	21.22	1.231
0.2270	0.2778	0.8262	168.54	21.71	1.096
0.2670	0.3268	0.8472	198.24	22.26	0.925
0.3070	0.3757	0.8651	227.93	22.73	0.772
0.3520	0.4308	0.8852	261.34	23.26	0.627
0.4020	0.4920	0.9023	298.46	23.71	0.483
0.4520	0.5532	0.9191	335.58	24.16	0.367
0.5020	0.6144	0.9343	372.71	24.55	0.272
0.5770	0.7062	0.9511	428.39	24.99	0.157
0.6520	0.7980	0.9670	484.07	25.41	0.084
0.7270	0.8898	0.9810	539.76	25.78	0.046
0.8020	0.9816	0.9881	595.43	25.96	0.019
0.8770	1.0734	0.9974	651.12	26.21	0.021
0.9770	1.1958	0.9997	725.36	26.27	0.021
1.0770	1.3182	1.0000	799.61	26.27	0.020

DATE 82068 RUN NO. 1

N= 4 X= 45.64 IN. UG= 49.19 FT/SEC REDELTA2= 1618.8

CF/2= 0.00138 VWALL/UG= 0.00433 K= 0.145E-05

VWALLPLUS= 0.1085 PPLUS= -0.02824

DEL= 0.693 IN. DELTA2= 0.0645 IN. H= 1.385

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0101	0.3032	6.52	8.16	1.709
0.0080	0.0115	0.3295	7.45	8.87	1.763
0.0090	0.0130	0.3624	8.39	9.75	1.835
0.0100	0.0144	0.3869	9.31	10.41	1.885
0.0110	0.0159	0.4108	10.25	11.05	1.932
0.0130	0.0187	0.4516	12.11	12.16	2.010
0.0150	0.0216	0.4861	13.97	13.08	2.069
0.0170	0.0245	0.5066	15.84	13.64	2.090
0.0200	0.0288	0.5325	18.63	14.34	2.109
0.0240	0.0346	0.5596	22.36	15.06	2.114
0.0290	0.0418	0.5886	27.01	15.85	2.117
0.0340	0.0490	0.6064	31.67	16.33	2.081
0.0400	0.0577	0.6252	37.27	16.83	2.038
0.0480	0.0692	0.6493	44.72	17.48	1.985
0.0560	0.0808	0.6682	52.16	17.98	1.922
0.0660	0.0952	0.6920	61.49	18.63	1.853
0.0790	0.1139	0.7163	73.59	19.29	1.756
0.0940	0.1355	0.7411	87.57	19.95	1.646
0.1110	0.1601	0.7632	103.40	20.55	1.521
0.1290	0.1861	0.7836	120.18	21.09	1.394
0.1490	0.2149	0.8040	138.80	21.64	1.266
0.1740	0.2510	0.8273	162.10	22.27	1.122
0.2040	0.2942	0.8493	190.04	22.87	0.961
0.2390	0.3446	0.8709	222.65	23.44	0.796
0.2790	0.4023	0.8924	259.91	24.02	0.636
0.3290	0.4744	0.9164	306.49	24.67	0.485
0.3790	0.5465	0.9330	353.07	25.12	0.357
0.4290	0.6186	0.9482	399.65	25.53	0.266
0.4790	0.6907	0.9594	446.23	25.83	0.192
0.5290	0.7628	0.9690	492.81	26.09	0.141
0.6040	0.8710	0.9799	562.67	26.38	0.089
0.6790	0.9791	0.9888	632.54	26.62	0.070
0.7540	1.0873	0.9949	702.41	26.78	0.067
0.8290	1.1954	0.9981	772.28	26.87	0.077
0.9040	1.3036	0.9991	842.14	26.89	0.069
1.0040	1.4478	1.0000	935.30	26.92	0.073

DATE 82068 RUN NO. 1

N= 5 X= 49.52 IN. UG= 57.04 FT/SEC REDELTA2= 1588.7

CF/2= 0.00145 VWALL/UG= 0.00406 K= 0.1546E-05

VWALLPLUS= 0.1065 PPLUS= -0.00597

DEL= 0.606 IN. DELTA2= 0.056 IN. H= 1.372

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0099	0.3231	6.65	8.48	1.747
0.0070	0.0116	0.3625	7.76	9.51	1.925
0.0080	0.0132	0.3959	8.87	10.38	1.893
0.0100	0.0165	0.4557	11.09	11.95	2.014
0.0130	0.0215	0.4990	14.41	13.09	2.069
0.0160	0.0264	0.5349	17.73	14.03	2.107
0.0210	0.0347	0.5744	23.29	15.06	2.119
0.0270	0.0446	0.6055	29.93	15.89	2.095
0.0370	0.0611	0.6468	41.01	16.97	2.038
0.0470	0.0776	0.6759	52.10	17.73	1.960
0.0620	0.1023	0.7037	68.73	18.44	1.837
0.0770	0.1271	0.7309	85.36	19.18	1.716
0.0920	0.1519	0.7635	101.98	20.04	1.603
0.1120	0.1849	0.7905	124.15	20.73	1.456
0.1320	0.2179	0.8135	146.32	21.35	1.324
0.1520	0.2509	0.8329	168.49	21.86	1.199
0.1770	0.2922	0.8549	196.21	22.42	1.064
0.2070	0.3417	0.8803	229.46	23.11	0.927
0.2370	0.3912	0.8968	262.71	23.51	0.807
0.2770	0.4572	0.9174	307.05	24.07	0.679
0.3270	0.5398	0.9360	362.48	24.55	0.545
0.3770	0.6223	0.9510	417.90	24.95	0.447
0.4520	0.7461	0.9689	501.03	25.41	0.352
0.5270	0.8699	0.9816	584.17	25.75	0.304
0.6270	1.0350	0.9923	695.02	26.03	0.281
0.7270	1.2000	0.9981	805.87	26.18	0.283
0.8270	1.3651	0.9997	916.72	26.22	0.286
0.9270	1.5302	1.0000	1027.57	26.23	0.287

DATE 82068 RUN NO. 1

N= 6 X= 61.77 IN. UG= 73.48 FT/SEC REDELTA2= 2952.5

CF/2= 0.00080 VWALL/UG= 0.00398 K= 0.000E 00

VWALLPLUS= 0.1409 PPLUS= 0.00000

DEL= 0.670 IN. DELTA2= 0.0923 IN. H= 1.563

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0090	0.2287	6.09	8.09
0.0070	0.0105	0.2384	7.10	8.44
0.0080	0.0119	0.2601	8.12	9.21
0.0090	0.0134	0.2858	9.14	10.11
0.0100	0.0149	0.3085	10.14	10.92
0.0110	0.0164	0.3263	11.16	11.55
0.0120	0.0179	0.3405	12.17	12.04
0.0130	0.0194	0.3535	13.19	12.51
0.0150	0.0224	0.3770	15.22	13.33
0.0170	0.0254	0.3905	17.24	13.82
0.0200	0.0299	0.4113	20.29	14.55
0.0250	0.0373	0.4348	25.36	15.38
0.0320	0.0478	0.4630	32.46	16.38
0.0420	0.0627	0.4932	42.61	17.45
0.0520	0.0777	0.5164	52.76	18.27
0.0620	0.0926	0.5370	62.90	19.00
0.0770	0.1150	0.5660	78.12	20.02
0.0920	0.1374	0.5921	93.34	20.95
0.1120	0.1673	0.6226	113.62	22.03
0.1320	0.1972	0.6520	133.91	23.07
0.1570	0.2345	0.6847	159.27	24.22
0.1820	0.2718	0.7169	184.64	25.37
0.2070	0.3092	0.7453	210.01	26.37
0.2320	0.3465	0.7744	235.37	27.40
0.2570	0.3839	0.7994	260.73	28.28
0.2820	0.4212	0.8230	286.09	29.12
0.3120	0.4660	0.8526	316.53	30.16
0.3420	0.5108	0.8777	346.96	31.05
0.3720	0.5556	0.8985	377.40	31.79
0.4020	0.6004	0.9174	407.83	32.46
0.4420	0.6602	0.9364	448.42	33.13
0.4720	0.7050	0.9481	478.85	33.54
0.5220	0.7797	0.9653	529.57	34.15
0.5720	0.8544	0.9765	580.30	34.55
0.6220	0.9290	0.9852	631.02	34.86
0.6720	1.0037	0.9903	681.76	35.03
0.7720	1.1531	0.9975	783.20	35.29
0.8720	1.3024	0.9993	884.65	35.35
0.9720	1.4518	1.0000	986.11	35.38

DATE 82068 RUN NO. 1

N= 7 X= 69.70 IN. UG= 73.30 FT/SEC REDELTA2= 4355.7

CF/2= 0.00068 VWALL/UG= 0.00392 K= 0.000E 00

VWALLPLUS= 0.1525 PPLUS= 0.00000

DEL= 0.868 IN. DELTA2= 0.1217 IN. H= 1.611

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0069	0.1949	5.61	7.46
0.0070	0.0081	0.2168	6.54	8.29
0.0080	0.0092	0.2359	7.48	9.03
0.0090	0.0104	0.2526	8.42	9.67
0.0110	0.0127	0.2847	10.29	10.90
0.0130	0.0150	0.3069	12.16	11.75
0.0160	0.0184	0.3331	14.96	12.75
0.0200	0.0230	0.3555	18.71	13.61
0.0250	0.0288	0.3802	23.38	14.55
0.0320	0.0369	0.4033	29.94	15.44
0.0410	0.0472	0.4263	38.35	16.32
0.0510	0.0588	0.4481	47.71	17.15
0.0660	0.0761	0.4765	61.73	18.24
0.0810	0.0933	0.5025	75.77	19.24
0.1010	0.1164	0.5297	94.48	20.27
0.1210	0.1394	0.5536	113.19	21.19
0.1360	0.1567	0.5701	127.21	21.82
0.1610	0.1855	0.5958	150.60	22.81
0.1910	0.2201	0.6226	178.66	23.83
0.2310	0.2662	0.6604	216.08	25.28
0.2710	0.3123	0.6949	253.51	26.60
0.3160	0.3641	0.7312	295.59	27.99
0.3610	0.4163	0.7651	337.65	29.29
0.4110	0.4736	0.7993	384.45	30.60
0.4610	0.5312	0.8370	431.21	32.04
0.5110	0.5888	0.8685	477.98	33.26
0.5610	0.6465	0.8992	524.76	34.42
0.6110	0.7041	0.9226	571.53	35.31
0.6610	0.7617	0.9435	618.30	36.12
0.7110	0.8193	0.9616	665.07	36.81
0.7860	0.9057	0.9758	735.21	37.53
0.8860	1.0210	0.9923	828.77	37.98
0.9860	1.1362	0.9973	922.31	38.17
1.0860	1.2514	0.9993	1015.85	38.25
1.1860	1.3667	1.0000	1109.38	38.27

DATE 82068 RUN NO. 1

N= 8 X= 85.78 IN. UG= 70.31 FT/SEC REDELTA2= 7196.9

CF/2= 0.00053 VWALL/UG= 0.00399 K= 0.000E 00

VWALLPLUS= 0.1733 PPLUS= 0.00000

DEL= 1.315 IN. DELTA2= 0.2010 IN. H= 1.648

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0046	0.1567	4.95	6.81
0.0070	0.0053	0.1707	5.77	7.42
0.0080	0.0061	0.1872	6.59	8.13
0.0090	0.0068	0.2023	7.42	8.79
0.0110	0.0084	0.2286	9.07	9.93
0.0130	0.0099	0.2504	10.71	10.87
0.0160	0.0122	0.2746	13.19	11.92
0.0200	0.0152	0.2998	16.49	13.02
0.0240	0.0183	0.3174	19.78	13.79
0.0290	0.0221	0.3355	23.90	14.57
0.0370	0.0281	0.3571	30.51	15.51
0.0470	0.0358	0.3793	38.75	16.47
0.0630	0.0479	0.4047	51.93	17.58
0.0830	0.0631	0.4339	68.42	18.85
0.1030	0.0783	0.4572	84.91	19.86
0.1280	0.0974	0.4796	105.51	20.83
0.1580	0.1202	0.5076	130.25	22.05
0.1930	0.1468	0.5320	159.11	23.11
0.2330	0.1772	0.5582	192.08	24.25
0.2730	0.2077	0.5817	225.06	25.27
0.3130	0.2381	0.6065	258.03	26.35
0.3530	0.2685	0.6260	291.01	27.19
0.3930	0.2989	0.6495	323.98	28.21
0.4430	0.3370	0.6768	365.20	29.40
0.4930	0.3750	0.7005	406.42	30.43
0.5430	0.4130	0.7241	447.64	31.45
0.5930	0.4511	0.7505	488.86	32.60
0.6680	0.5081	0.7842	550.68	34.06
0.7430	0.5652	0.8171	612.51	35.49
0.8180	0.6222	0.8516	674.34	36.99
0.8930	0.6793	0.8827	736.17	38.34
0.9930	0.7553	0.9185	818.60	39.89
1.0930	0.8314	0.9502	901.04	41.27
1.1930	0.9075	0.9736	983.47	42.29
1.2930	0.9835	0.9884	1065.91	42.93
1.3930	1.0596	0.9959	1148.35	43.26
1.4930	1.1357	0.9982	1230.78	43.36
1.5930	1.2117	0.9993	1313.22	43.40
1.6930	1.2878	0.9998	1395.66	43.42
1.7930	1.3639	1.0000	1478.09	43.43

							$C_f/2 \times 10^3$				
DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	$F \times 10^3$	$K \times 10^6$	$RE_{\delta 2}$	H	$K(H+1)RE_{\delta 2}-F$	MOMENTUM INTEGRAL EQUATION	SUBLAYER (2 PTS.)	BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
120867/4	±0.02	±0.12	±0.03	±13%	±2.5%	±0.04	±0.80	±0.80	±0.15		±6.0
M = 1	29.96	30.34	6.07	0.0	3000	1.671	--	--	0.60	0.60	5.2
M = 2	53.97	37.39	6.06	0.788	3664	1.439	0.98	0.90	1.00	0.90	1.5
M = 3	66.77	46.15	5.95	0.769	3642	1.416	0.82	0.80	0.77	0.82	5.3
M = 4	77.79	57.62	6.05	0.793	3635	1.405	0.89	0.86	0.68	0.86	4.8
82668/4	±0.02	±0.04	±0.04	±10%	±3.0%	±0.032	±0.70	±0.85	±0.15		±5.0
M = 1	13.78	26.16	5.78	0.0	1681	1.729	--	--	1.09	0.82	-6.1
M = 2	29.67	32.08	5.80	1.39	2026	1.481	1.20	1.24	1.02	1.02	-0.1
M = 3	37.69	39.38	5.83	1.42	2032	1.433	1.16	1.04	1.05	1.05	-2.0
M = 4	45.64	50.81	5.87	1.45	2008	1.430	1.22	1.07	0.97	1.07	-1.6
82268/3	±0.02	±0.03	±0.03		±1.0%	±0.032			±0.10		±5.0
M = 1	61.77	73.41	5.78	0.0	3765	1.639	--	--	0.38	0.53	--
M = 2	69.70	72.97	5.80	0.0	5641	1.730	--	--	0.27	0.35	1.9
M = 3	85.78	73.05	5.79	0.0	9367	1.772	--	--	0.21	0.28	1.1

SETUP DATA

VWALL/UG= 0.006

RUN:	120867-1	92668-1	82268-1
PBARO (IN. HG) =	30.12	29.95	29.98
TAMBIENT (DEG-F) =	70.5	76.6	76.7
RELATIVE HUMIDITY =	0.45	0.54	0.41
TGAS (DEG-F) =	64.90	75.39	70.83
GAS DENSITY (LBM/FT3) =	0.0758	0.0736	0.0744
GAS VISCOSITY (FT2/SEC) =	0.160E-03	0.167E-03	0.164E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	30.34	0.01382	26.14	0.01109	25.23	0.01111
3.953	30.34		26.14		25.23	
5.953	30.34	0.01390	26.14	0.01109	25.30	0.01106
7.961	30.34		26.14		25.32	
9.969	30.34	0.01384	26.14	0.01106	25.27	0.01112
11.953	30.34		26.14		25.27	
13.937	30.34	0.01393	26.16	0.01113	25.29	0.01113
15.945	30.34		26.23		25.36	
17.953	30.34	0.01387	26.37	0.01115	25.55	0.01119
19.922	30.34		26.91		26.06	
21.938	30.34	0.01374	27.64	0.01169	26.80	0.01171
23.954	30.34		28.47		27.67	
25.962	30.34	0.01380	29.49	0.01253	28.68	0.01261
27.962	30.34		30.94		30.03	
29.978	30.34	0.01396	32.23	0.01369	31.44	0.01379
31.939	30.34		33.69		32.90	
33.955	30.34	0.01391	35.51	0.01512	34.66	0.01520
35.955	30.52		37.45		36.61	
37.971	30.93	0.01424	39.53	0.01689	38.67	0.01691
39.987	31.39		41.98		41.09	
41.963	31.95	0.01460	44.47	0.01909	43.63	0.01913
43.963	32.63		47.51		46.69	
45.963	33.45	0.01533	50.95	0.02193	50.12	0.02201
47.979	34.34		55.07		54.26	
49.979	35.25	0.01623	59.87	0.02579	59.10	0.02582
51.979	36.23		65.37		64.75	
53.995	37.35	0.01717	71.04	0.03057	70.33	0.03079
55.971	38.52		72.91		72.13	
57.971	39.72	0.01810	72.75	0.03123	72.10	0.03158
59.955	41.03		72.83		72.21	
61.979	42.43	0.01941	72.74	0.03135	72.11	0.03149
63.971	43.89		72.77		72.13	
65.979	45.44	0.02079	72.72	0.03137	72.13	0.03145
67.963	47.20		72.75		72.13	
69.971	48.97	0.02245	72.74	0.03127	72.11	0.03140
71.979	50.87		72.71		72.09	
73.963	52.96	0.02427	72.69	0.03125	72.10	0.03145
75.939	55.18		72.64		72.04	
77.947	57.84	0.02637	72.68	0.03139	72.07	0.03153
79.939	60.71		72.66		72.07	
81.931	63.87	0.02940	72.68	0.03131	72.07	0.03149
83.962	67.10		72.68		72.07	
85.931	70.51	0.03284	72.69	0.03124	72.07	0.03141
87.915	74.09		72.63		72.03	
89.939	78.01	0.03375	72.58	0.03060	71.98	0.03076
91.931	82.21		72.55		71.98	
93.947	86.85	0.03609	72.47	0.03120	71.88	0.03136

DATE 121867 RUN NO. 1

M= 1 X= 29.96 IN. UG= 33.34 FT/SEC REDELTA2= 30[illegible].2

CF/2= 0.00360 VWALL/UG= 0.00617 K= 0.0000E 00

VWALLPLUS= 0.2478 PPLUS= 0.00000

DEL= 1.293 IN. DELTA2= 0.1900 IN. H= 1.671

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0046	0.0962	2.32	2.83
0.0070	0.0054	0.1043	2.71	4.26
0.0080	0.0062	0.1212	3.10	4.95
0.0090	0.0070	0.1526	3.48	6.23
0.0100	0.0077	0.1746	3.87	7.12
0.0110	0.0085	0.1878	4.26	7.67
0.0130	0.0101	0.2038	5.03	8.32
0.0160	0.0124	0.2229	6.19	9.10
0.0210	0.0162	0.2484	8.13	10.14
0.0310	0.0240	0.3089	12.00	12.61
0.0410	0.0317	0.3386	15.86	13.82
0.0560	0.0433	0.3788	21.66	15.46
0.0710	0.0549	0.4004	27.47	16.35
0.0910	0.0704	0.4350	35.21	17.76
0.1160	0.0897	0.4640	44.87	18.95
0.1460	0.1129	0.4891	56.48	19.97
0.1860	0.1439	0.5268	71.95	21.51
0.2360	0.1825	0.5704	91.29	23.28
0.2860	0.2212	0.6070	110.64	24.78
0.3360	0.2599	0.6302	129.99	25.73
0.4110	0.3179	0.6813	159.00	27.81
0.4860	0.3759	0.7222	188.02	29.48
0.5610	0.4339	0.7577	217.03	30.94
0.6360	0.4919	0.7917	246.05	32.32
0.7110	0.5499	0.8243	275.05	33.65
0.7860	0.6079	0.8500	304.07	34.70
0.8610	0.6659	0.8885	333.09	36.27
0.9360	0.7239	0.9124	362.10	37.25
1.0110	0.7819	0.9357	391.12	38.19
1.0860	0.8399	0.9566	420.13	39.03
1.1610	0.8979	0.9756	449.15	39.84
1.2360	0.9559	0.9831	478.16	40.13
1.3360	1.0333	0.9952	516.84	40.62
1.4360	1.1106	0.9988	555.54	40.77
1.5360	1.1880	1.0000	594.22	40.82

DATE 121867 RUN NO. 1

M= 2 X= 53.97 IN. UG= 37.39 FT/SEC REDELTA2= 3663.6

CF/2= 0.00[illegible] VWALL/UG= 0.00[illegible] K= [illegible].748E-06

VWALLPLUS= 0.2020 PPLUS= -0.02917

DEL= 1.573 IN. DELTA2= 0.1881 IN. H= 1.439

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0038	0.1833	3.51	6.11
0.0080	0.0051	0.2151	4.67	7.17
0.0110	0.0070	0.2555	6.42	8.51
0.0150	0.0095	0.3063	8.76	10.21
0.0200	0.0127	0.3452	11.67	11.50
0.0250	0.0159	0.3777	14.59	12.59
0.0310	0.0197	0.4039	18.10	13.46
0.0380	0.0242	0.4358	22.18	14.52
0.0480	0.0305	0.4656	28.02	15.52
0.0580	0.0369	0.4855	33.86	16.18
0.0730	0.0464	0.5138	42.61	17.12
0.0880	0.0560	0.5378	51.36	17.93
0.1080	0.0687	0.5664	63.04	18.88
0.1280	0.0814	0.5935	74.72	19.78
0.1480	0.0941	0.6144	86.39	20.48
0.1730	0.1100	0.6383	100.98	21.27
0.2030	0.1291	0.6614	118.49	22.04
0.2380	0.1513	0.6829	138.92	22.75
0.2730	0.1736	0.7052	159.35	23.50
0.3130	0.1990	0.7250	182.70	24.16
0.3530	0.2245	0.7422	206.05	24.74
0.3980	0.2531	0.7590	232.32	25.30
0.4430	0.2817	0.7775	258.58	25.91
0.4930	0.3135	0.7955	287.77	26.52
0.5530	0.3516	0.8112	322.79	27.04
0.6180	0.3930	0.8266	360.73	27.55
0.6930	0.4406	0.8492	404.51	28.30
0.7680	0.4883	0.8639	448.28	28.79
0.8430	0.5360	0.8819	492.06	29.39
0.9180	0.5837	0.8943	535.84	29.81
0.9930	0.6314	0.9118	579.62	30.39
1.0680	0.6791	0.9264	623.40	30.88
1.1430	0.7268	0.9427	667.17	31.36
1.2180	0.7745	0.9524	710.95	31.75
1.2930	0.8221	0.9623	754.73	32.07
1.3930	0.8857	0.9745	813.10	32.47
1.4930	0.9493	0.9849	871.47	32.83
1.5930	1.0129	0.9913	929.84	33.04
1.6930	1.0765	0.9961	988.21	33.20
1.7930	1.1401	0.9976	1046.58	33.25
1.8930	1.2037	1.0000	1104.95	33.33

DATE 121867 RUN NO. 1

M= 3 X= 66.77 IN. UG= 46.15 FT/SEC REDELTA2= 3642.0

CF/2= 0.00282 VWALL/UG= 0.00595 K= 0.769E-06

VWALLPLUS= 0.2076 PPLUS= -0.03273

DEL= 1.452 IN. DELTA2= 0.1517 IN. H= 1.416

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0041	0.1693	4.13	5.91	2.094
0.0070	0.0048	0.1966	4.82	6.86	2.269
0.0080	0.0055	0.2119	5.50	7.40	2.360
0.0090	0.0062	0.2329	6.19	8.13	2.490
0.0120	0.0083	0.2870	8.25	10.01	2.917
0.0150	0.0103	0.3304	10.32	11.53	3.071
0.0180	0.0124	0.3646	12.38	12.73	3.261
0.0220	0.0151	0.3907	15.13	13.63	3.371
0.0280	0.0193	0.4237	19.26	14.79	3.499
0.0360	0.0248	0.4543	24.76	15.86	3.576
0.0440	0.0303	0.4830	30.26	16.86	3.643
0.0540	0.0372	0.5040	37.14	17.59	3.624
0.0640	0.0441	0.5300	44.01	18.50	3.648
0.0790	0.0544	0.5567	54.33	19.43	3.604
0.0940	0.0647	0.5803	64.64	20.26	3.548
0.1090	0.0751	0.6013	74.96	20.99	3.480
0.1290	0.0888	0.6316	88.72	22.05	3.421
0.1490	0.1026	0.6525	102.47	22.77	3.306
0.1740	0.1198	0.6774	119.67	23.65	3.175
0.1990	0.1370	0.7044	136.86	24.59	3.076
0.2240	0.1542	0.7218	154.05	25.20	2.927
0.2540	0.1749	0.7464	174.69	26.05	2.793
0.2840	0.1956	0.7622	195.32	26.61	2.618
0.3240	0.2231	0.7836	222.82	27.36	2.412
0.3640	0.2506	0.8006	250.34	27.94	2.195
0.4040	0.2782	0.8210	277.85	28.66	2.040
0.4540	0.3126	0.8360	312.23	29.18	1.796
0.5040	0.3470	0.8519	346.62	29.74	1.589
0.5640	0.3884	0.8688	387.88	30.33	1.362
0.6290	0.4331	0.8830	432.59	30.82	1.124
0.7040	0.4848	0.8992	484.17	31.39	0.896
0.7790	0.5364	0.9129	535.75	31.87	0.694
0.8540	0.5881	0.9264	587.33	32.34	0.533
0.9290	0.6397	0.9364	638.91	32.69	0.383
1.0040	0.6913	0.9462	690.49	33.03	0.263
1.1540	0.7946	0.9647	793.65	33.68	0.107
1.3040	0.8979	0.9796	896.81	34.20	0.032
1.4540	1.0012	0.9901	999.97	34.56	0.008
1.5540	1.0701	0.9943	1068.75	34.71	0.005
1.6540	1.1389	0.9975	1137.52	34.83	0.013
1.7540	1.2078	0.9990	1206.29	34.87	0.015
1.8540	1.2766	1.0000	1275.07	34.90	0.019

DATE 121867 RUN NO. 1

M= 4 X= 77.79 IN. UG= 57.42 FT/SEC REDELTA2= 3634.6

CF/2= 0.00186 VWALL/UG= 0.00505 K= 0.793E-06

VWALLPLUS= 0.2067 PPLUS= -0.03147

DEL= 1.259 IN. DELTA2= 0.1214 IN. H= 1.465

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0048	0.2147	5.27	7.32	2.347
0.0070	0.0056	0.2456	6.14	8.35	2.534
0.0080	0.0064	0.2671	7.03	9.11	2.662
0.0100	0.0079	0.3086	8.78	10.52	2.904
0.0120	0.0095	0.3334	10.54	11.37	[illegible]
0.0160	0.0127	0.3835	14.05	13.08	3.287
0.0200	0.0159	0.4183	17.56	14.26	3.437
0.0240	0.0191	0.4384	21.07	14.95	3.489
0.0300	0.0238	0.4670	26.34	15.93	3.560
0.0370	0.0294	0.4933	32.49	16.83	3.597
0.0470	0.0373	0.5215	41.27	17.79	3.590
0.0570	0.0453	0.5464	50.06	18.64	3.567
0.0670	0.0532	0.5690	58.83	19.41	3.536
0.0770	0.0612	0.5885	67.62	20.07	3.488
0.0920	0.0731	0.6150	80.79	20.97	3.413
0.1070	0.0850	0.6394	93.96	21.81	3.332
0.1220	0.0969	0.6598	107.13	22.51	3.237
0.1420	0.1128	0.6855	124.69	23.38	3.115
0.1620	0.1287	0.7046	142.25	24.03	2.964
0.1820	0.1446	0.7250	159.82	24.73	2.838
0.2020	0.1604	0.7440	177.38	25.37	2.716
0.2220	0.1763	0.7591	194.94	25.89	2.584
0.2470	0.1962	0.7772	216.89	26.51	2.429
0.2720	0.2160	0.7933	238.84	27.05	2.279
0.3020	0.2399	0.8115	265.19	27.68	2.117
0.3320	0.2637	0.8277	291.53	28.23	1.954
0.3620	0.2875	0.8420	317.87	28.72	1.805
0.3970	0.3153	0.8569	348.61	29.22	1.640
0.4370	0.3471	0.8723	383.73	29.75	1.472
0.4820	0.3828	0.8859	423.25	30.21	1.286
0.5320	0.4226	0.9007	467.15	30.73	1.115
0.5920	0.4702	0.9125	519.84	31.12	0.932
0.6570	0.5218	0.9269	576.91	31.61	0.725
0.7320	0.5814	0.9397	642.77	32.05	0.554
0.8320	0.6609	0.9527	730.59	32.49	0.358
0.9320	0.7403	0.9635	818.42	32.86	0.211
1.0820	0.8594	0.9785	950.12	33.37	0.182
1.2320	0.9785	0.9888	1081.82	33.72	0.122
1.3320	1.0580	0.9937	1169.64	33.89	[illegible]
1.4320	1.1374	0.9955	1257.45	33.95	[illegible]
1.5320	1.2169	0.9987	1345.25	34.07	[illegible]
1.6320	1.2963	0.9993	1433.07	34.09	[illegible]
1.7320	1.3757	1.0000	1520.89	34.11	[illegible]

DATE 82668 RUN NO. 1

N= 1 X= 13.78 IN. UG= 26.14 FT/SEC REDELTA2= 1690.6

CF/2= 0.00082 VWALL/UG= 0.00578 K= 0.000E 00

VWALLPLUS= 0.2014 PPLUS= 0.00000

DEL= 0.841 IN. DELTA2= 0.1290 IN. H= 1.729

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0071	0.1109	2.24	3.87
0.0070	0.0083	0.1274	2.62	4.44
0.0080	0.0095	0.1421	2.99	4.96
0.0090	0.0107	0.1596	3.36	5.56
0.0110	0.0131	0.2082	4.12	7.26
0.0130	0.0155	0.2352	4.86	8.19
0.0150	0.0178	0.2449	5.60	8.53
0.0180	0.0214	0.2632	6.73	9.17
0.0220	0.0262	0.2804	8.22	9.77
0.0270	0.0321	0.3244	10.09	11.30
0.0330	0.0392	0.3538	12.34	12.33
0.0430	0.0511	0.3722	16.07	12.97
0.0580	0.0689	0.4105	21.68	14.30
0.0780	0.0927	0.4492	29.15	15.65
0.0980	0.1165	0.4744	36.63	16.54
0.1230	0.1462	0.5103	45.97	17.78
0.1580	0.1878	0.5370	59.06	18.71
0.2080	0.2473	0.5879	77.74	20.49
0.2580	0.3067	0.6345	96.43	22.11
0.3080	0.3661	0.6784	115.12	23.64
0.3580	0.4256	0.7224	133.81	25.17
0.4080	0.4850	0.7612	152.49	26.53
0.4580	0.5445	0.7952	171.19	27.71
0.5080	0.6039	0.8339	189.88	29.05
0.5580	0.6633	0.8727	209.57	30.41
0.6080	0.7229	0.9000	227.25	31.36
0.6580	0.7822	0.9314	245.94	32.45
0.7080	0.8416	0.9594	264.63	33.44
0.7580	0.9011	0.9714	283.32	33.85
0.8080	0.9605	0.9867	302.00	34.38
0.8580	1.0200	0.9917	320.69	34.56
0.9080	1.0794	0.9967	339.39	34.73
0.9580	1.1388	0.9983	358.07	34.79
1.0080	1.1983	1.0000	376.76	34.85

DATE 82668 RUN NO. 1

N= 2 X= 29.67 IN. UG= 32.08 FT/SEC REDELTA2= 2025.6

CF/2= 0.00162 VWALL/UG= 0.00590 K= 0.139E-05

VWALLPLUS= 0.1819 PPLUS= -0.04298

DEL= 1.002 IN. DELTA2= 0.1269 IN. H= 1.491

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0080	0.1871	4.07	5.97
0.0090	0.0090	0.1985	4.58	6.23
0.0110	0.0110	0.2481	5.60	7.76
0.0130	0.0130	0.2751	6.62	8.63
0.0150	0.0150	0.2946	7.64	9.24
0.0180	0.0180	0.3419	9.17	10.72
0.0210	0.0210	0.3699	10.69	11.60
0.0250	0.0249	0.4053	12.73	12.71
0.0300	0.0299	0.4398	15.28	13.80
0.0370	0.0369	0.4673	18.84	14.66
0.0450	0.0449	0.4983	22.92	15.63
0.0550	0.0549	0.5271	28.09	16.53
0.0670	0.0668	0.5530	34.11	17.25
0.0800	0.0798	0.5788	40.73	18.16
0.0950	0.0948	0.5938	48.37	18.63
0.1150	0.1147	0.6228	58.55	19.53
0.1400	0.1397	0.6522	71.28	20.45
0.1700	0.1696	0.6819	86.56	21.39
0.2050	0.2045	0.7088	104.38	22.24
0.2450	0.2444	0.7287	124.75	22.86
0.2900	0.2893	0.7554	147.66	23.69
0.3400	0.3392	0.7804	173.13	24.48
0.3900	0.3891	0.8048	198.58	25.25
0.4400	0.4390	0.8291	224.04	26.00
0.4900	0.4889	0.8513	249.50	26.70
0.5400	0.5387	0.8642	274.96	27.13
0.5900	0.5886	0.8843	300.42	27.74
0.6650	0.6635	0.9101	338.61	28.54
0.7400	0.7383	0.9356	376.80	29.34
0.8150	0.8131	0.9549	414.99	29.96
0.8900	0.8879	0.9750	453.18	30.58
0.9650	0.9628	0.9845	491.36	30.88
1.0400	1.0376	0.9956	529.56	31.23
1.1150	1.1124	0.9978	567.74	31.30
1.2150	1.2122	1.0000	618.66	31.36

DATE 82668 RUN NO. 1

N= 3 X= 37.69 IN. UG= 39.38 FT/SEC REDELTA2= 2032.2

CF/2= 0.00165 VWALL/UG= 0.00583 K= 0.142E-05

VWALLPLUS= 0.1798 PPLUS= -0.04152

DEL= 0.940 IN. DELTA2= 0.1297 IN. H= 1.433

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0074	0.2158	4.44	6.65	2.016
0.0080	0.0085	0.2291	5.09	7.06	2.166
0.0090	0.0096	0.2648	5.72	8.16	2.237
0.0100	0.0106	0.2767	6.35	8.53	2.280
0.0120	0.0128	0.3201	7.63	9.87	2.472
0.0140	0.0149	0.3549	8.90	10.95	2.620
0.0160	0.0170	0.3767	10.16	11.62	2.695
0.0190	0.0202	0.4065	12.07	12.54	2.796
0.0230	0.0245	0.4410	14.62	13.60	2.899
0.0280	0.0298	0.4776	17.79	14.73	2.968
0.0350	0.0372	0.5024	22.24	15.49	2.993
0.0450	0.0479	0.5394	28.59	16.64	3.009
0.0570	0.0606	0.5749	36.22	17.73	2.987
0.0700	0.0745	0.6017	44.48	18.56	2.913
0.0850	0.0904	0.6295	54.01	19.41	2.821
0.1000	0.1064	0.6512	63.54	20.08	2.710
0.1200	0.1277	0.6765	76.25	20.86	2.556
0.1400	0.1490	0.7009	88.96	21.62	2.417
0.1650	0.1756	0.7315	104.85	22.56	2.268
0.1900	0.2022	0.7512	120.73	23.18	2.085
0.2250	0.2394	0.7761	142.97	23.94	1.841
0.2650	0.2820	0.8002	168.39	24.69	1.580
0.3150	0.3352	0.8290	200.16	25.57	1.301
0.3650	0.3884	0.8507	231.94	26.24	1.038
0.4150	0.4416	0.8694	263.71	26.81	0.803
0.4650	0.4948	0.8902	295.48	27.45	0.620
0.5150	0.5480	0.9073	327.25	27.99	0.478
0.5650	0.6012	0.9193	359.02	28.36	0.331
0.6150	0.6544	0.9327	390.79	28.77	0.224
0.6900	0.7342	0.9498	438.45	29.29	0.101
0.7650	0.8140	0.9658	486.11	29.79	0.039
0.8400	0.8938	0.9771	533.76	30.14	-0.002
0.9150	0.9735	0.9887	581.42	30.50	-0.005
0.9900	1.0535	0.9927	629.08	30.62	-0.037
1.0900	1.1597	0.9978	692.63	30.77	0.002
1.1900	1.2661	0.9993	756.17	30.82	0.003
1.2900	1.3725	1.0000	819.71	30.85	0.007

DATE 82668 RUN NO. 1

N= 4 X= 45.64 IN. UG= 53.81 FT/SEC REDELTA2= 2087.8

CF/2= 0.00167 VWALL/UG= 0.00587 K= 0.145E-05

VWALLPLUS= 0.1797 PPLUS= -0.04175

DEL= 0.783 IN. DELTA2= 0.0794 IN. H= 1.430

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0077	0.2280	4.95	6.99	2.055
0.0070	0.0089	0.2516	5.78	7.70	2.150
0.0080	0.0103	0.2751	6.63	8.42	2.248
0.0090	0.0115	0.2979	7.43	9.12	2.342
0.0100	0.0128	0.3274	8.26	10.03	2.474
0.0110	0.0141	0.3457	9.08	10.59	2.545
0.0130	0.0167	0.3738	10.73	11.45	2.639
0.0150	0.0192	0.4086	12.38	12.51	2.772
0.0170	0.0218	0.4357	14.03	13.34	2.864
0.0200	0.0256	0.4587	16.50	14.04	2.908
0.0230	0.0295	0.4817	18.99	14.75	2.955
0.0270	0.0346	0.5074	22.28	15.54	2.994
0.0310	0.0397	0.5270	25.58	16.14	3.001
0.0360	0.0461	0.5455	29.71	16.70	2.979
0.0430	0.0551	0.5656	35.49	17.32	2.924
0.0510	0.0654	0.5914	42.09	18.11	2.884
0.0610	0.0782	0.6176	50.34	18.91	2.811
0.0730	0.0936	0.6427	60.25	19.68	2.701
0.0860	0.1102	0.6680	70.98	20.40	2.591
0.1010	0.1294	0.6939	83.35	21.25	2.456
0.1180	0.1512	0.7170	97.39	21.96	2.291
0.1360	0.1743	0.7405	112.24	22.67	2.131
0.1560	0.1999	0.7627	128.75	23.35	1.957
0.1810	0.2320	0.7876	149.38	24.12	1.757
0.2110	0.2704	0.8140	174.14	24.92	1.537
0.2410	0.3089	0.8353	198.90	25.58	1.331
0.2760	0.3537	0.8576	227.79	26.26	1.114
0.3110	0.3986	0.8759	256.67	26.82	0.927
0.3460	0.4434	0.8923	285.56	27.32	0.763
0.3960	0.5075	0.9132	326.82	27.96	0.568
0.4460	0.5716	0.9280	368.09	28.41	0.395
0.4960	0.6357	0.9436	409.35	28.87	0.273
0.5460	0.6998	0.9537	450.61	29.20	0.167
0.6210	0.7959	0.9688	512.51	29.66	0.067
0.6960	0.8920	0.9805	574.41	30.02	0.014
0.7710	0.9881	0.9894	636.31	30.30	-0.002
0.8460	1.0843	0.9945	698.21	30.44	-0.012
0.9210	1.1804	0.9982	760.10	30.56	-0.065
0.9960	1.2765	0.9996	822.00	30.61	0.001
1.0960	1.4047	1.0000	904.54	30.62	0.002

82268 RUN NO. 1

N= 1 X= 61.77 IN. UG= 73.41 FT/SEC REDELTA2= 3765.0

CF/2= 0.00053 VWALL/UG= 0.00578 K= 0.000E 00

VWALLPLUS= 0.2520 PPLUS= 0.00000

DEL= 0.785 IN. DELTA2= 0.1015 IN. H= 1.639

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0076	0.1846	5.10	8.05
0.0070	0.0089	0.2028	5.96	8.85
0.0080	0.0102	0.2224	6.81	9.70
0.0090	0.0115	0.2413	7.65	10.53
0.0110	0.0140	0.2667	9.36	11.64
0.0130	0.0166	0.2971	11.06	12.96
0.0160	0.0204	0.3148	13.61	13.73
0.0190	0.0242	0.3328	16.17	14.51
0.0230	0.0293	0.3546	19.57	15.47
0.0290	0.0369	0.3785	24.67	16.51
0.0370	0.0471	0.4005	31.48	17.47
0.0470	0.0599	0.4296	39.99	18.73
0.0580	0.0739	0.4582	49.34	19.98
0.0700	0.0891	0.4830	59.55	21.06
0.0830	0.1057	0.5046	70.61	22.01
0.0980	0.1248	0.5319	83.37	23.20
0.1150	0.1464	0.5561	97.84	24.26
0.1330	0.1694	0.5846	113.15	25.50
0.1530	0.1948	0.6077	130.16	26.51
0.1780	0.2267	0.6433	151.43	28.06
0.2030	0.2585	0.6740	172.70	29.40
0.2330	0.2967	0.7081	198.22	30.89
0.2630	0.3349	0.7392	223.74	32.24
0.2930	0.3731	0.7718	249.27	33.66
0.3280	0.4177	0.8046	279.04	35.09
0.3580	0.4559	0.8296	304.56	36.18
0.3880	0.4941	0.8526	330.08	37.19
0.4230	0.5387	0.8774	359.85	38.27
0.4680	0.5960	0.8981	398.14	39.17
0.5180	0.6596	0.9282	440.68	40.49
0.5680	0.7233	0.9482	483.22	41.36
0.6180	0.7870	0.9630	525.75	42.01
0.6680	0.8506	0.9738	568.29	42.47
0.7380	0.9398	0.9853	627.84	42.97
0.8080	1.0289	0.9923	687.40	43.28
0.8830	1.1244	0.9968	751.20	43.47
0.9580	1.2199	0.9981	815.01	43.54
1.0580	1.3473	0.9994	900.08	43.59
1.1580	1.4746	1.0000	985.15	43.62

DATE 82268 RUN NO. 1

N= 2 X= 59.70 IN. UG= 72.97 FT/SEC REDELTA2= 5640.7

CF/2= 0.00035 VWALL/UG= 0.00590 K= 0.000E 00

VWALLPLUS= 0.3085 PPLUS= 0.00000

DEL= 1.019 IN. DELTA2= 0.1529 IN. H= 1.730

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0059	0.1316	4.15	7.01
0.0070	0.0069	0.1511	4.86	8.05
0.0080	0.0078	0.1620	5.55	8.62
0.0090	0.0088	0.1770	6.24	9.42
0.0100	0.0098	0.1908	6.93	10.16
0.0110	0.0108	0.2056	7.62	10.95
0.0130	0.0128	0.2261	9.01	12.04
0.0160	0.0157	0.2517	11.08	13.40
0.0210	0.0206	0.2757	14.56	14.68
0.0280	0.0275	0.3062	19.40	16.30
0.0380	0.0373	0.3339	26.33	17.78
0.0530	0.0520	0.3676	36.73	19.57
0.0730	0.0716	0.4037	50.58	21.49
0.1030	0.1011	0.4463	71.38	23.76
0.1330	0.1305	0.4818	92.16	25.65
0.1680	0.1648	0.5189	116.41	27.63
0.2080	0.2041	0.5543	144.12	29.51
0.2530	0.2482	0.5933	175.30	31.59
0.2980	0.2924	0.6312	206.49	33.60
0.3430	0.3365	0.6650	237.67	35.40
0.3880	0.3807	0.6978	268.95	37.15
0.4280	0.4199	0.7302	296.56	38.89
0.4780	0.4690	0.7614	331.21	40.53
0.5280	0.5180	0.7972	365.86	42.44
0.5780	0.5671	0.8288	400.50	44.12
0.6280	0.6162	0.8578	435.15	45.67
0.6780	0.6652	0.8828	469.80	47.00
0.7280	0.7143	0.9075	504.44	48.32
0.7780	0.7633	0.9291	539.09	49.46
0.8280	0.8124	0.9489	573.73	50.51
0.8780	0.8614	0.9646	608.38	51.35
0.9530	0.9353	0.9817	660.35	52.26
1.0280	1.0086	0.9911	712.31	52.76
1.1280	1.1067	0.9970	781.60	53.08
1.2280	1.2048	0.9994	850.90	53.20
1.3280	1.3029	0.9998	920.19	53.22
1.4280	1.4011	1.0000	989.48	53.23

DATE 82268 RUN NO. 1

N= 3 X= 85.78 IN. UG= 73.05 FT/SEC REDELTA2= 9366.6

CF/2= 0.00028 VWALL/UG= 0.00579 K= 0.000E 00

VWALLPLUS= 0.3453 PPLUS= 0.00000

DEL= 1.580 IN. DELTA2= 0.2537 IN. H= 1.772

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0038	0.1042	3.72	6.21
0.0070	0.0044	0.1157	4.34	6.90
0.0080	0.0051	0.1262	4.95	7.52
0.0090	0.0057	0.1328	5.57	7.91
0.0110	0.0070	0.1549	6.81	9.24
0.0140	0.0089	0.1801	8.67	10.74
0.0180	0.0114	0.2052	11.14	12.23
0.0230	0.0146	0.2256	14.24	13.51
0.0300	0.0190	0.2530	18.57	15.08
0.0400	0.0253	0.2768	24.77	16.50
0.0530	0.0335	0.3030	32.82	18.06
0.0680	0.0430	0.3257	42.11	19.42
0.0880	0.0557	0.3548	54.51	21.15
0.1130	0.0715	0.3850	69.99	22.95
0.1430	0.0905	0.4114	88.57	24.53
0.1780	0.1126	0.4411	110.24	26.29
0.2280	0.1443	0.4766	141.21	28.39
0.2780	0.1759	0.5018	172.18	29.92
0.3280	0.2075	0.5311	203.14	31.67
0.3880	0.2455	0.5589	240.30	33.33
0.4530	0.2866	0.5926	280.56	35.33
0.5280	0.3341	0.6284	327.01	37.47
0.6030	0.3816	0.6643	373.45	39.61
0.6780	0.4290	0.6959	419.90	41.48
0.7530	0.4765	0.7301	466.35	43.53
0.8280	0.5239	0.7617	512.81	45.42
0.9030	0.5714	0.7974	559.26	47.54
0.9780	0.6188	0.8256	605.71	49.21
1.0780	0.6821	0.8626	667.64	51.42
1.1780	0.7454	0.8977	729.57	53.52
1.2780	0.8087	0.9309	791.50	55.49
1.3780	0.8719	0.9574	853.43	57.08
1.4780	0.9352	0.9772	915.36	58.26
1.5780	0.9985	0.9898	977.33	59.31
1.6780	1.0618	0.9964	1039.24	59.40
1.7780	1.1250	0.9983	1101.17	59.52
1.8780	1.1883	0.9992	1163.10	59.57
1.9780	1.2516	0.9998	1225.03	59.61
2.0780	1.3149	1.0000	1286.96	59.62

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	$F \times 10^3$	$K \times 10^6$	RE_{δ_2}	H	$K(H+1)RE_{\delta_2}-F$	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
52068/4	±0.02	±0.09	±0.02	±10%	±3.1%	±0.05	±0.15	±0.20	±0.25		±12.0
M = 1	29.90	41.13	-0.98	0.0	1211	1.324	--	--	2.94	2.70	10.0
M = 2	53.86	50.28	-0.98	0.586	1328	1.271	2.74	2.50	2.62	2.50	1.1
M = 3	66.83	61.58	-0.98	0.570	1237	1.278	2.58	2.48	2.48	2.48	-5.7
M = 4	77.79	76.61	-1.01	0.594	1192	1.293	2.64	2.51	2.31	2.51	-3.7
52168/4	±0.02	±0.12	±0.02	±14%	±6.0%	±0.09	±0.25	±0.35	±0.30		±11.5
M = 1	29.90	30.38	-0.95	0.0	863	1.362	--	--	3.04	2.86	12.4
M = 2	53.86	37.09	-0.97	0.784	1060	1.290	2.87	2.61	2.83	2.70	2.8
M = 3	66.83	45.48	-0.97	0.767	985	1.289	2.70	2.59	2.89	2.67	-5.1
M = 4	77.79	56.50	-0.98	0.787	950	1.304	2.70	2.57	2.61	2.57	-6.5
80568/8	±0.02	±0.12	±0.02	±10%	±5.0%	±0.105	±0.30	±0.50	±0.30		±10.0
M = 1	13.78	25.30	-0.96	0.0	800	1.437	--	--	2.72	2.72	-11.7
M = 2	29.67	30.93	-0.95	1.41	805	1.321	3.59	2.58	3.23	2.80	-8.0
M = 3	37.69	37.65	-0.96	1.37	664	1.340	3.09	2.69	2.86	2.78	-8.3
M = 4	45.64	48.43	-0.95	1.48	589	1.359	3.00	2.72	2.90	2.82	-7.9
M = 5	49.63	56.39	-0.96	1.45	558	1.386	2.89	2.58	2.69	2.75	-2.8
M = 6	61.77	69.83	-0.95	0.0	964	1.395	--	--	2.24	2.70	-0.3
M = 7	69.70	69.65	-0.95	0.0	1376	1.376	--	--	2.14	2.50	-1.5
M = 8	85.78	69.31	-0.94	0.0	2105	1.350	--	--	1.97	2.30	0.5

SETUP DATA

VWALL/UG= -0.001

RUN:	52068-1	52168-1	80568-1
PBARO (IN. HG) =	29.91	29.90	29.85
TAMBIENT (DEG-F) =	75.0	76.5	77.8
RELATIVE HUMIDITY =	0.65	0.45	0.45
TGAS (DEG-F) =	69.75	67.55	67.[illegible]9
GAS DENSITY (LBM/FT3) =	0.0746	0.0748	0.0745
GAS VISCOSITY (FT2/SEC) =	0.164E-03	0.163E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	41.23	-0.00301	30.38	-0.00222	25.12	-0.00182
3.953	41.23		30.38		25.48	
5.953	41.2[illegible]	-0.00298	30.38	-0.00217	25.46	-0.00182
7.961	41.17		30.37		25.48	
9.969	41.[illegible]2	-0.00298	30.35	-0.00219	25.39	-0.00182
11.953	41.12		30.35		25.30	
13.937	41.17	-0.00301	30.38	-0.00218	25.30	-0.00181
15.945	41.13		30.35		25.35	
17.953	41.12	-0.00299	30.36	-0.00219	25.52	-0.00182
19.922	41.06		30.35		25.87	
21.938	41.04	-0.00301	30.35	-0.00218	26.64	-0.00192
23.954	41.01		30.29		27.51	
25.962	41.09	-0.00300	30.35	-0.00216	28.66	-0.00201
27.962	41.12		30.38		29.85	
29.978	41.13	-0.00301	30.38	-0.00216	31.24	-0.00219
31.939	41.17		30.42		32.64	
33.955	41.28	-0.00299	30.53	-0.00217	34.42	-0.00240
35.955	41.42		30.64		36.35	
37.971	41.82	-0.00305	30.82	-0.00222	38.27	-0.00270
39.987	42.38		31.29		40.43	
41.963	43.11	-0.00314	31.92	-0.00229	42.80	-0.00299
43.963	44.03		32.58		45.69	
45.963	45.06	-0.00329	33.29	-0.00239	49.10	-0.00342
47.979	46.26		34.12		52.99	
49.979	47.48	-0.00347	35.15	-0.00254	57.52	-0.00404
51.979	48.85		36.09		52.70	
53.995	50.45	-0.00366	37.19	-0.00269	68.50	-0.00481
55.971	51.90		38.31		70.13	
57.971	53.51	-0.00387	39.49	-0.00288	69.90	-0.00488
59.955	55.22		40.77		69.84	
61.979	57.00	-0.00418	42.14	-0.00306	69.64	-0.00493
63.971	58.82		43.39		69.55	
65.979	60.88	-0.00448	44.84	-0.00329	69.46	-0.00494
67.963	63.10		46.55		69.48	
69.971	65.49	-0.00487	48.22	-0.00353	69.42	-0.00493
71.979	68.03		50.11		69.32	
73.963	70.89	-0.00529	52.18	-0.00380	69.26	-0.00496
75.939	73.76		54.34		69.16	
77.947	77.24	-0.00577	36.84	-0.00414	69.16	-0.00493
79.939	80.98		59.55		69.13	
81.931	85.19	-0.00630	62.61	-0.00428	69.13	-0.00486
83.962	89.67		65.92		69.13	
85.931	94.50	-0.00703	69.46	-0.00512	69.06	-0.00483
87.915	99.78		73.37		69.00	
89.939	105.77	-0.00787	77.70	-0.00579	69.03	-0.00493
91.931	112.38		82.49		68.93	
93.947	119.74	-0.00860	87.96	-0.00646	68.91	-0.00488

DATE 52068 RUN NO. 1

N= 1 X= [illegible].49 IN. UG= 41.13 FT/SEC REDELTA2= 1210.8

CF/2= 0.00270 VWALL/UG= -0.00[illegible]39 K= [illegible]

VWALLPLUS= -0.0188 PPLUS= 0.00000

DEL= 0.657 IN. DELTA2= 0.0579 IN. H= 1.324

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0091	0.3561	6.54	6.95
0.0070	0.0107	0.3951	7.62	7.56
0.0080	0.0122	0.4300	8.70	8.27
0.0090	0.0137	0.4554	9.79	8.76
0.0100	0.0152	0.4794	10.88	9.22
0.0110	0.0168	0.5049	11.97	9.71
0.0130	0.0198	0.5427	14.15	10.44
0.0150	0.0228	0.5677	16.33	10.92
0.0170	0.0259	0.5914	18.51	11.38
0.0190	0.0289	0.6125	20.68	11.78
0.0210	0.0320	0.6253	22.86	12.03
0.0240	0.0365	0.6451	26.12	12.41
0.0290	0.0442	0.6672	31.57	12.83
0.0350	0.0533	0.6877	38.10	13.23
0.0420	0.0640	0.7057	45.72	13.58
0.0500	0.0761	0.7196	54.43	13.84
0.0600	0.0914	0.7323	65.31	14.09
0.0700	0.1066	0.7457	76.19	14.34
0.0830	0.1264	0.7615	90.34	14.64
0.0950	0.1447	0.7778	103.41	14.96
0.1100	0.1675	0.7936	119.74	15.27
0.1250	0.1903	0.8045	136.07	15.48
0.1450	0.2208	0.8224	157.84	15.82
0.1700	0.2588	0.8422	185.06	16.20
0.1950	0.2969	0.8586	212.27	16.51
0.2200	0.3350	0.8733	239.48	16.79
0.2500	0.3807	0.8888	272.13	17.09
0.2850	0.4340	0.9057	310.23	17.42
0.3200	0.4873	0.9195	348.33	17.69
0.3700	0.5634	0.9436	402.76	18.15
0.4200	0.6395	0.9533	457.19	18.34
0.4700	0.7157	0.9657	511.61	18.57
0.5200	0.7918	0.9766	566.04	18.78
0.5700	0.8680	0.9833	620.47	18.91
0.6200	0.9441	0.9880	674.89	19.01
0.6700	1.0202	0.9907	729.32	19.06
0.7200	1.0964	0.9927	783.75	19.09
0.7700	1.1725	0.9960	838.17	19.15
0.8200	1.2486	0.9980	892.60	19.20
0.8700	1.3248	0.9993	947.02	19.22
0.9200	1.4009	1.0000	1001.45	19.24

DATE 52068 RUN NO. 1

N= 2 X= 53.86 IN. UG= 53.28 FT/SEC REDELTA2= 1327.7

CF/2= 0.00250 VWALL/UG= -0.00098 K= 0.586E-06

VWALLPLUS= -0.0195 PPLUS= -0.00469

DEL= 0.703 IN. DELTA2= 0.0519 IN. H= 1.271

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0085	0.3732	7.69	7.46
0.0070	0.0100	0.4126	8.96	8.24
0.0080	0.0114	0.4436	10.24	8.86
0.0090	0.0128	0.4882	11.52	9.76
0.0100	0.0142	0.5266	12.80	10.52
0.0110	0.0157	0.5584	14.08	11.16
0.0120	0.0171	0.5809	15.36	11.60
0.0140	0.0199	0.6156	17.92	12.31
0.0160	0.0228	0.6403	20.47	12.79
0.0190	0.0270	0.6713	24.31	13.42
0.0220	0.0313	0.6895	28.16	13.78
0.0260	0.0370	0.7135	33.28	14.26
0.0310	0.0441	0.7342	39.68	14.68
0.0370	0.0526	0.7503	47.36	15.00
0.0440	0.0626	0.7643	56.32	15.28
0.0540	0.0768	0.7821	69.11	15.63
0.0690	0.0982	0.8027	88.32	16.04
0.0890	0.1266	0.8245	113.91	16.47
0.1140	0.1622	0.8462	145.91	16.91
0.1440	0.2049	0.8648	184.31	17.28
0.1790	0.2547	0.8825	229.11	17.64
0.2140	0.3045	0.8979	273.91	17.95
0.2540	0.3614	0.9102	325.11	18.19
0.2940	0.4183	0.9256	376.30	18.49
0.3440	0.4894	0.9379	440.30	18.74
0.3940	0.5606	0.9482	504.29	18.95
0.4440	0.6317	0.9584	568.30	19.15
0.5190	0.7384	0.9731	664.29	19.44
0.5940	0.8452	0.9817	760.29	19.62
0.6690	0.9519	0.9880	856.28	19.74
0.7440	1.0586	0.9925	952.28	19.84
0.8190	1.1653	0.9947	1048.27	19.88
0.8940	1.2720	0.9969	1144.26	19.92
0.9690	1.3787	0.9991	1240.26	19.97
1.0440	1.4854	1.0000	1336.25	19.98

DATE 52068 RUN NO. 1

N= 3 X= 66.83 IN. UG= 61.58 FT/SEC REDELTA2= 1236.8

CF/2= 0.00248 VWALL/UG= -0.00[illegible]39 K= 0.570E-06

VWALLPLUS= -0.0196 PPLUS= -0.00463

DEL= 0.583 IN. DELTA2= 0.0395 IN. H= 1.278

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0103	0.4290	9.36	8.61	0.792
0.0070	0.0120	0.4646	10.91	9.31	0.773
0.0080	0.0137	0.5266	12.49	10.56	0.743
0.0090	0.0154	0.5618	14.06	11.28	0.724
0.0100	0.0172	0.5844	15.61	11.72	0.711
0.0110	0.0189	0.6120	17.17	12.28	0.695
0.0120	0.0206	0.6324	18.73	12.69	0.683
0.0130	0.0223	0.6467	20.29	12.98	0.673
0.0150	0.0257	0.6709	23.41	13.46	0.656
0.0170	0.0292	0.6917	26.53	13.88	0.640
0.0190	0.0326	0.7069	29.65	14.19	0.627
0.0220	0.0378	0.7230	34.33	14.50	0.610
0.0260	0.0446	0.7395	40.57	14.84	0.590
0.0320	0.0549	0.7588	49.94	15.22	0.564
0.0390	0.0669	0.7746	60.86	15.54	0.538
0.0490	0.0841	0.7956	76.47	15.96	0.503
0.0620	0.1064	0.8150	96.75	16.36	0.463
0.0780	0.1339	0.8354	121.72	16.76	0.419
0.0940	0.1613	0.8518	146.69	17.09	0.381
0.1140	0.1956	0.8715	177.91	17.47	0.339
0.1340	0.2300	0.8861	209.12	17.78	0.301
0.1540	0.2643	0.8996	240.32	18.04	0.268
0.1790	0.3072	0.9130	279.34	18.32	0.232
0.2040	0.3501	0.9244	318.36	18.55	0.202
0.2340	0.4016	0.9338	365.17	18.74	0.171
0.2690	0.4616	0.9451	419.79	18.96	0.142
0.3090	0.5303	0.9547	482.21	19.15	0.110
0.3590	0.6161	0.9643	561.24	19.35	0.081
0.4090	0.7019	0.9725	639.27	19.51	0.059
0.4590	0.7877	0.9785	716.30	19.63	0.042
0.5340	0.9164	0.9857	833.34	19.77	0.023
0.6090	1.0451	0.9922	950.38	19.91	0.013
0.6840	1.1738	0.9953	1067.42	19.97	0.007
0.7590	1.3025	0.9988	1184.47	20.04	0.005
0.8340	1.4312	0.9994	1301.51	20.05	0.004
0.9090	1.5599	1.0000	1418.55	20.07	0.004

DATE 52068 RUN NO. 1

N= 4 X= 77.79 IN. UG= 76.61 FT/SEC REDELTA2= 1192.4

CF/2= 0.00251 VWALL/UG= -0.00101 K= 0.594E-06

VWALLPLUS= -0.0202 PPLUS= -0.00473

DEL= 0.465 IN. DELTA2= 0.0306 IN. H= 1.293

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0065	0.0140	0.5046	12.67	10.07	0.744
0.0075	0.0161	0.5516	14.61	11.01	0.719
0.0085	0.0183	0.5949	16.57	11.88	0.695
0.0095	0.0204	0.6301	18.52	12.58	0.678
0.0105	0.0226	0.6508	20.47	12.99	0.662
0.0115	0.0247	0.6666	22.41	13.30	0.651
0.0125	0.0269	0.6821	24.36	13.61	0.640
0.0145	0.0312	0.7063	28.26	14.10	0.620
0.0165	0.0355	0.7226	32.16	14.43	0.605
0.0195	0.0419	0.7403	38.01	14.78	0.585
0.0225	0.0484	0.7536	43.85	15.04	0.568
0.0265	0.0570	0.7669	51.65	15.31	0.547
0.0325	0.0699	0.7829	63.34	15.63	0.519
0.0395	0.0849	0.7998	76.99	15.97	0.489
0.0495	0.1064	0.8189	96.48	16.35	0.451
0.0595	0.1279	0.8344	115.98	16.66	0.416
0.0725	0.1559	0.8527	141.31	17.02	0.376
0.0845	0.1817	0.8667	164.70	17.30	0.345
0.0995	0.2139	0.8822	193.93	17.61	0.306
0.1195	0.2569	0.9004	232.92	17.97	0.265
0.1395	0.2999	0.9147	271.90	18.26	0.227
0.1645	0.3537	0.9290	320.63	18.55	0.190
0.1895	0.4074	0.9390	369.36	18.74	0.159
0.2195	0.4719	0.9509	427.83	18.98	0.128
0.2545	0.5472	0.9619	496.04	19.20	0.100
0.2895	0.6224	0.9694	564.26	19.35	0.078
0.3295	0.7084	0.9757	642.23	19.47	0.059
0.3795	0.8159	0.9825	739.69	19.61	0.041
0.4295	0.9234	0.9877	837.14	19.72	0.028
0.5045	1.0847	0.9925	983.32	19.81	0.016
0.5795	1.2459	0.9952	1129.51	19.86	0.009
0.6545	1.4071	0.9975	1275.69	19.91	0.005
0.7295	1.5684	0.9985	1421.86	19.93	0.003
0.8045	1.7296	0.9990	1568.05	19.94	0.002
0.8795	1.8909	0.9996	1714.23	19.96	0.001
0.9545	2.0521	1.0000	1860.42	19.96	0.002

DATE 52168 RUN NO. 1

N= 1 X= 29.94 IN. UG= 30.38 FT/SEC REDELTA2= 862.7

CF/2= 0.00286 VWALL/UG= -0.00095 K= 3.009E-07

VWALLPLUS= -0.0178 PPLUS= 0.00300

DEL= 0.651 IN. DELTA2= 0.0555 IN. H= 1.362

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0107	0.3100	5.82	5.95
0.0080	0.0123	0.3507	6.65	6.96
0.0090	0.0138	0.3676	7.48	6.88
0.0100	0.0154	0.3993	8.31	7.47
0.0120	0.0184	0.4480	9.97	8.38
0.0140	0.0215	0.4939	11.63	9.24
0.0160	0.0246	0.5293	13.30	9.90
0.0180	0.0276	0.5539	14.96	10.36
0.0210	0.0322	0.5898	17.45	11.03
0.0250	0.0384	0.6234	20.75	11.66
0.0290	0.0445	0.6483	24.10	12.13
0.0340	0.0522	0.6667	28.25	12.47
0.0400	0.0614	0.6916	33.25	12.94
0.0470	0.0722	0.7105	39.06	13.29
0.0560	0.0860	0.7290	46.53	13.64
0.0660	0.1013	0.7456	54.85	13.95
0.0810	0.1244	0.7614	67.31	14.25
0.0960	0.1474	0.7802	79.78	14.60
0.1160	0.1781	0.7970	96.40	14.91
0.1360	0.2088	0.8100	113.02	15.31
0.1660	0.2549	0.8441	137.95	15.79
0.1960	0.3009	0.8625	162.88	16.14
0.2360	0.3623	0.8856	196.13	16.57
0.2860	0.4391	0.9115	237.68	17.05
0.3460	0.5312	0.9377	287.54	17.54
0.3960	0.6080	0.9543	329.09	17.85
0.4460	0.6848	0.9706	370.64	18.14
0.5210	0.7999	0.9805	432.97	18.35
0.5960	0.9151	0.9866	495.29	18.46
0.6960	1.0686	0.9927	578.40	18.58
0.7960	1.2222	0.9988	661.50	18.69
0.8960	1.3757	1.0000	744.61	18.71

DATE 52168 RUN NO. 1

N= 2 X= 53.86 IN. UG= 37.09 FT/SEC REDELTA2= 1059.7

CF/2= 0.00270 VWALL/UG= -0.00097 K= 1.784E-06

VWALLPLUS= -0.0187 PPLUS= -0.00561

DEL= 0.753 IN. DELTA2= 0.0559 IN. H= 1.290

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0093	0.3480	6.99	6.70
0.0080	0.0106	0.3876	7.88	7.47
0.0090	0.0120	0.4178	8.87	8.04
0.0100	0.0133	0.4405	9.85	8.49
0.0110	0.0146	0.4759	10.83	9.16
0.0120	0.0159	0.5072	11.83	9.77
0.0130	0.0173	0.5322	12.81	10.25
0.0150	0.0199	0.5690	14.78	10.96
0.0170	0.0226	0.5995	16.75	11.55
0.0190	0.0252	0.6260	18.72	12.05
0.0210	0.0279	0.6451	20.69	12.42
0.0230	0.0306	0.6662	22.66	12.83
0.0260	0.0345	0.6901	25.62	13.29
0.0290	0.0385	0.7017	28.57	13.51
0.0320	0.0425	0.7177	31.53	13.82
0.0360	0.0478	0.7345	35.47	14.15
0.0410	0.0545	0.7487	40.39	14.41
0.0480	0.0639	0.7640	47.29	14.72
0.0560	0.0744	0.7795	55.17	15.01
0.0660	0.0877	0.7949	65.02	15.31
0.0760	0.1010	0.8040	74.88	15.48
0.0910	0.1209	0.8200	89.65	15.79
0.1110	0.1475	0.8396	109.35	16.17
0.1360	0.1807	0.8539	133.99	16.45
0.1660	0.2206	0.8680	163.54	16.72
0.2060	0.2737	0.8874	202.95	17.09
0.2560	0.3401	0.9146	252.21	17.62
0.3060	0.4066	0.9157	301.47	17.71
0.3810	0.5062	0.9398	375.35	18.10
0.4560	0.6059	0.9561	449.25	18.41
0.5560	0.7387	0.9704	547.77	18.69
0.6560	0.8716	0.9836	646.29	18.95
0.7560	1.0045	0.9902	744.81	19.07
0.8560	1.1374	0.9968	843.32	19.19
0.9560	1.2702	0.9984	941.84	19.23
1.0560	1.4031	0.9992	1040.36	19.24
1.1560	1.5360	1.0000	1138.88	19.25

DATE 52168 RUN NO. 1

N= 3 X= 65.83 IN. UG= 45.48 FT/SEC REDELTA2= 985.2

CF/2= 0.00267 VWALL/UG= -0.00097 K= 0.767E-06

VWALLPLUS= -0.0187 PPLUS= -0.00555

DEL= 0.636 IN. DELTA2= 0.0424 IN. H= 1.289

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0094	0.3732	7.21	7.21	0.928
0.0070	0.0110	0.4245	8.42	8.22	0.803
0.0080	0.0126	0.4587	9.62	8.87	0.786
0.0090	0.0141	0.4971	10.82	9.62	0.767
0.0100	0.0157	0.5286	12.02	10.22	0.751
0.0110	0.0173	0.5516	13.23	10.67	0.737
0.0120	0.0189	0.5670	14.43	10.97	0.727
0.0130	0.0204	0.5967	15.63	11.54	0.712
0.0140	0.0220	0.6186	16.84	11.95	0.701
0.0150	0.0236	0.6293	18.04	12.17	0.692
0.0160	0.0251	0.6361	19.24	12.30	0.686
0.0180	0.0283	0.6635	21.65	12.83	0.669
0.0210	0.0330	0.6937	25.25	13.42	0.647
0.0240	0.0377	0.7151	28.86	13.83	0.629
0.0280	0.0440	0.7345	33.67	14.21	0.610
0.0320	0.0503	0.7519	38.48	14.54	0.592
0.0370	0.0581	0.7668	44.49	14.83	0.573
0.0420	0.0660	0.7787	50.51	15.06	0.555
0.0470	0.0738	0.7876	56.51	15.23	0.539
0.0570	0.0896	0.8045	68.55	15.57	0.509
0.0670	0.1053	0.8211	80.57	15.88	0.481
0.0770	0.1210	0.8296	92.60	16.05	0.457
0.0920	0.1446	0.8451	110.63	16.35	0.423
0.1070	0.1681	0.8603	128.67	16.64	0.391
0.1270	0.1995	0.8746	152.72	16.91	0.356
0.1520	0.2388	0.8911	182.78	17.24	0.313
0.1820	0.2860	0.9084	218.86	17.57	0.271
0.2220	0.3488	0.9249	266.96	17.89	0.225
0.2720	0.4274	0.9428	327.09	18.24	0.179
0.3320	0.5217	0.9553	399.24	18.48	0.138
0.4020	0.6316	0.9671	483.42	18.71	0.102
0.4920	0.7730	0.9787	591.64	18.93	0.070
0.5920	0.9302	0.9882	711.89	19.12	0.049
0.6920	1.0873	0.9926	832.14	19.20	0.037
0.7920	1.2444	0.9984	952.40	19.31	0.033
0.8920	1.4015	0.9995	1072.66	19.33	0.032
0.9920	1.5587	1.0000	1192.91	19.34	0.032

DATE 52169 RUN NO. 1

N= 4 X= 77.79 IN. UG= 56.50 FT/SEC REDELTA2= 950.4

CF/2= 0.00257 VWALL/UG= -0.00096 K= 0.787E-06

VWALLPLUS= -0.0194 PPLUS= -0.00435

DEL= 0.495 IN. DELTA2= 0.0329 IN. H= 1.306

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0121	0.4156	8.78	8.20	0.793
0.0070	0.0142	0.4519	10.24	8.91	0.772
0.0080	0.0162	0.4933	11.71	9.73	0.746
0.0090	0.0182	0.5361	13.17	10.58	0.727
0.0100	0.0202	0.5727	14.63	11.30	0.707
0.0110	0.0222	0.6030	16.10	11.90	0.689
0.0120	0.0242	0.6275	17.56	12.38	0.675
0.0140	0.0283	0.6626	20.49	13.03	0.652
0.0160	0.0323	0.6855	23.41	13.53	0.633
0.0190	0.0384	0.7145	27.81	14.10	0.609
0.0220	0.0444	0.7328	32.20	14.46	0.589
0.0270	0.0545	0.7596	39.51	14.99	0.560
0.0330	0.0667	0.7786	48.30	15.37	0.532
0.0410	0.0828	0.7973	60.00	15.74	0.498
0.0500	0.1010	0.8151	73.17	16.08	0.465
0.0610	0.1232	0.8320	89.27	16.42	0.428
0.0730	0.1475	0.8475	106.84	16.72	0.397
0.0900	0.1818	0.8658	131.71	17.09	0.347
0.1100	0.2222	0.8834	160.98	17.43	0.301
0.1330	0.2687	0.9030	194.65	17.82	0.255
0.1630	0.3292	0.9206	238.55	18.17	0.207
0.1980	0.3999	0.9372	289.77	18.49	0.162
0.2380	0.4807	0.9513	348.31	18.77	0.123
0.2830	0.5716	0.9640	414.17	19.02	0.090
0.3330	0.6726	0.9734	487.35	19.21	0.063
0.3930	0.7939	0.9806	575.16	19.35	0.040
0.4580	0.9251	0.9870	670.29	19.47	0.023
0.5230	1.0564	0.9923	765.41	19.58	0.013
0.5980	1.2079	0.9940	875.14	19.62	0.005
0.6730	1.3594	0.9983	984.93	19.70	0.002
0.7480	1.5109	0.9983	1094.71	19.72	0.001
0.8230	1.6624	0.9997	1204.46	19.73	0.001
0.8980	1.8139	1.0000	1314.23	19.73	0.001

DATE 83568 RUN NO. 1

N= 1 X= 13.78 IN. UG= 25.30 FT/SEC REDELTA2= 800.4

CF/2= 0.00272 VWALL/UG= -0.00396 K= 0.000E 00

VWALLPLUS= -0.0185 PPLUS= 0.00000

DEL= 0.526 IN. DELTA2= 0.0621 IN. H= 1.437

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0080	0.0152	0.2759	5.38	5.29
0.0090	0.0171	0.2883	6.05	5.53
0.0100	0.0190	0.3282	6.73	6.29
0.0110	0.0209	0.3638	7.40	6.97
0.0120	0.0228	0.3808	8.07	7.30
0.0140	0.0266	0.4178	9.42	8.01
0.0160	0.0304	0.4579	10.76	8.78
0.0180	0.0342	0.4767	12.11	9.14
0.0210	0.0399	0.5245	14.13	10.05
0.0240	0.0456	0.5423	16.15	10.40
0.0280	0.0532	0.5854	18.83	11.22
0.0320	0.0608	0.6059	21.53	11.62
0.0380	0.0723	0.6396	25.56	12.27
0.0470	0.0894	0.6569	31.61	12.59
0.0620	0.1179	0.6946	41.71	13.31
0.0770	0.1464	0.7096	51.79	13.61
0.0970	0.1844	0.7423	65.25	14.23
0.1220	0.2320	0.7572	82.06	14.51
0.1470	0.2795	0.7845	98.88	15.04
0.1770	0.3366	0.7999	119.06	15.34
0.2120	0.4031	0.8299	142.60	15.92
0.2470	0.4697	0.8528	166.14	16.35
0.2970	0.5647	0.8818	199.77	16.90
0.3470	0.6598	0.9161	233.41	17.56
0.3970	0.7549	0.9461	267.04	18.14
0.4470	0.8500	0.9644	300.69	18.49
0.4970	0.9450	0.9859	334.30	18.91
0.5470	1.0401	0.9930	367.93	19.04
0.5970	1.1352	0.9975	401.57	19.13
0.6720	1.2778	1.0000	452.01	19.17

DATE 83568 RUN NO. 1

N= 2 X= 25.67 IN. UG= 30.93 FT/SEC REDELTA2= 835.3

CF/2= 0.00280 VWALL/UG= -0.00375 K= 0.241E-05

VWALLPLUS= -0.0183 PPLUS= -0.00355

DEL= 0.643 IN. DELTA2= 0.0511 IN. H= 1.321

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0093	0.2931	5.00	5.55
0.0070	0.0109	0.3214	5.84	6.08
0.0080	0.0124	0.3627	6.67	6.86
0.0090	0.0140	0.3878	7.51	7.33
0.0100	0.0156	0.4170	8.34	7.88
0.0110	0.0171	0.4447	9.17	8.39
0.0120	0.0187	0.4722	10.01	8.93
0.0130	0.0202	0.4987	10.84	9.43
0.0140	0.0218	0.5146	11.67	9.92
0.0160	0.0249	0.5585	13.35	10.56
0.0180	0.0280	0.5930	15.01	11.21
0.0200	0.0311	0.6098	16.67	11.52
0.0220	0.0342	0.6349	18.34	12.00
0.0240	0.0373	0.6477	20.01	12.24
0.0270	0.0420	0.6777	22.52	12.81
0.0300	0.0467	0.7015	25.02	13.26
0.0340	0.0529	0.7180	28.35	13.57
0.0410	0.0638	0.7436	34.19	14.06
0.0510	0.0793	0.7729	42.53	14.61
0.0610	0.0949	0.7953	50.86	15.04
0.0760	0.1182	0.8070	63.37	15.25
0.0960	0.1493	0.8285	80.04	15.66
0.1210	0.1882	0.8453	100.89	15.98
0.1510	0.2349	0.8603	125.92	16.27
0.1860	0.2893	0.8813	155.09	16.66
0.2260	0.3515	0.8937	188.44	16.90
0.2760	0.4293	0.9124	230.13	17.24
0.3260	0.5071	0.9324	271.82	17.62
0.3760	0.5849	0.9409	313.51	17.79
0.4260	0.6626	0.9582	355.21	18.11
0.4760	0.7404	0.9651	396.90	18.32
0.5260	0.8182	0.9823	438.58	18.57
0.6010	0.9348	0.9878	501.12	18.67
0.6760	1.0515	0.9918	563.65	18.74
0.7510	1.1681	0.9977	626.19	18.86
0.8260	1.2848	0.9988	688.73	18.89
0.9010	1.4015	1.0000	751.26	18.91

DATE 83568 RUN NO. 1

N= 3 X= 37.69 IN. UG= 37.65 FT/SEC REDELTA2= 664.4

CF/2= 0.00278 VWALL/UG= -0.00396 K= 0.137E-05

VWALLPLUS= -0.0182 PPLUS= -0.00932

DEL= 0.506 IN. DELTA2= 0.0345 IN. H= 1.340

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0138	0.3512	7.09	6.66
0.0080	0.0158	0.3915	8.10	7.42
0.0090	0.0178	0.4299	9.11	8.15
0.0100	0.0198	0.4786	10.12	9.08
0.0110	0.0217	0.5137	11.13	9.74
0.0120	0.0237	0.5333	12.14	10.11
0.0140	0.0277	0.5828	14.17	11.05
0.0160	0.0316	0.6285	16.19	11.92
0.0180	0.0356	0.6572	18.22	12.46
0.0200	0.0395	0.6815	20.24	12.93
0.0230	0.0455	0.7154	23.28	13.57
0.0260	0.0514	0.7372	26.30	13.97
0.0300	0.0593	0.7604	30.35	14.41
0.0350	0.0692	0.7809	35.41	14.81
0.0410	0.0810	0.8019	41.48	15.21
0.0480	0.0949	0.8154	48.56	15.53
0.0570	0.1127	0.8318	57.67	15.78
0.0700	0.1383	0.8478	70.83	16.07
0.0900	0.1779	0.8672	91.06	16.44
0.1100	0.2174	0.8843	111.30	16.76
0.1350	0.2668	0.9002	136.59	17.07
0.1700	0.3360	0.9176	171.99	17.39
0.2100	0.4150	0.9321	212.47	17.67
0.2600	0.5139	0.9476	263.06	17.96
0.3100	0.6127	0.9597	313.64	18.20
0.3600	0.7115	0.9695	364.23	18.38
0.4100	0.8103	0.9792	414.81	18.57
0.4600	0.9091	0.9846	465.40	18.67
0.5100	1.0079	0.9905	515.99	18.78
0.5600	1.1068	0.9960	566.58	18.88
0.6350	1.2550	0.9984	642.47	18.93
0.7100	1.4032	1.0000	718.34	18.96

DATE 83568 RUN NO. 1

N= 4 X= 45.64 IN. UG= 49.43 FT/SEC REDELTA2= 588.6

CF/2= 0.00282 VWALL/UG= -0.00395 K= 0.148E-05

VWALLPLUS= -0.0178 PPLUS= -0.00988

DEL= 0.378 IN. DELTA2= 0.0237 IN. H= 1.359

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0065	0.0172	0.4179	8.51	7.87
0.0075	0.0198	0.4634	9.82	8.73
0.0085	0.0225	0.5020	11.13	9.45
0.0095	0.0251	0.5475	12.45	10.31
0.0105	0.0278	0.5846	13.75	11.01
0.0115	0.0304	0.6122	15.07	11.53
0.0125	0.0331	0.6340	16.37	11.94
0.0135	0.0357	0.6591	17.69	12.41
0.0145	0.0384	0.6728	18.99	12.67
0.0165	0.0436	0.7047	21.61	13.26
0.0185	0.0489	0.7267	24.23	13.68
0.0205	0.0542	0.7468	26.85	14.06
0.0235	0.0622	0.7689	30.79	14.47
0.0265	0.0701	0.7897	34.72	14.86
0.0305	0.0807	0.8053	39.96	15.16
0.0355	0.0939	0.8229	46.50	15.49
0.0415	0.1098	0.8401	54.37	15.82
0.0495	0.1309	0.8548	64.85	16.09
0.0615	0.1627	0.8725	80.56	16.42
0.0765	0.2024	0.8909	100.21	16.77
0.0965	0.2553	0.9089	126.42	17.11
0.1215	0.3214	0.9266	159.17	17.44
0.1565	0.4140	0.9450	205.02	17.79
0.1965	0.5199	0.9580	257.42	18.03
0.2565	0.6785	0.9739	336.02	18.34
0.3315	0.8769	0.9846	434.27	18.53
0.3815	1.0091	0.9904	499.78	18.64
0.4565	1.2075	0.9962	598.03	18.76
0.5565	1.4721	0.9981	729.03	18.79
0.6565	1.7366	1.0000	860.03	18.83

DATE 81568 RUN NO. 1

N= 5 X= 49.63 IN. UG= 56.39 FT/SEC REDELTA2= 557.9

CF/2= 0.00275 VWALL/UG= -0.00196 K= 0.145E-05

VWALLPLUS= -0.0194 PPLUS= -0.01995

DEL= 0.319 IN. DELTA2= 0.0194 IN. H= 1.386

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0188	0.4219	9.02	8.05
0.0070	0.0220	0.4463	10.53	8.51
0.0080	0.0251	0.4967	12.03	9.37
0.0090	0.0282	0.5471	13.54	10.44
0.0100	0.0314	0.5922	15.04	11.30
0.0110	0.0345	0.6275	16.55	11.98
0.0120	0.0376	0.6555	18.05	12.51
0.0130	0.0408	0.6798	19.56	12.97
0.0140	0.0439	0.7002	21.06	13.36
0.0150	0.0471	0.7162	22.57	13.67
0.0170	0.0533	0.7432	25.57	14.18
0.0190	0.0596	0.7619	28.58	14.53
0.0210	0.0659	0.7807	31.59	14.90
0.0240	0.0753	0.7985	36.10	15.24
0.0280	0.0878	0.8186	42.11	15.62
0.0330	0.1035	0.8386	49.64	16.01
0.0400	0.1255	0.8555	60.16	16.33
0.0490	0.1537	0.8724	73.71	16.65
0.0610	0.1914	0.8888	91.76	16.96
0.0760	0.2384	0.9061	114.32	17.28
0.0940	0.2949	0.9226	141.43	17.61
0.1140	0.3576	0.9367	171.48	17.87
0.1390	0.4361	0.9512	209.08	18.15
0.1740	0.5459	0.9648	261.73	18.41
0.2240	0.7027	0.9779	336.94	18.66
0.2890	0.9066	0.9872	434.71	18.84
0.3540	1.1105	0.9937	532.48	18.96
0.4290	1.3458	0.9972	645.30	19.03
0.5040	1.5811	0.9996	758.12	19.08
0.5790	1.8164	1.0000	870.93	19.08

DATE 81568 RUN NO. 1

N= 6 X= 61.77 IN. UG= 69.83 FT/SEC REDELTA2= 964.2

CF/2= 0.00270 VWALL/UG= -0.00395 K= 0.000E 00

VWALLPLUS= -0.0183 PPLUS= 0.00000

DEL= 0.296 IN. DELTA2= 0.0272 IN. H= 1.395

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0203	0.4413	11.08	8.48
0.0070	0.0237	0.4888	12.93	9.40
0.0080	0.0271	0.5260	14.78	10.11
0.0090	0.0304	0.5558	16.63	10.69
0.0100	0.0338	0.5817	18.47	11.18
0.0110	0.0372	0.6057	20.32	11.64
0.0120	0.0406	0.6185	22.17	11.89
0.0130	0.0440	0.6317	24.02	12.15
0.0150	0.0507	0.6518	27.71	12.53
0.0170	0.0575	0.6692	31.39	12.87
0.0210	0.0710	0.6889	38.78	13.24
0.0260	0.0879	0.7099	48.02	13.65
0.0330	0.1116	0.7316	60.95	14.07
0.0430	0.1455	0.7570	79.43	14.56
0.0560	0.1894	0.7844	103.43	15.08
0.0710	0.2402	0.8132	131.14	15.63
0.0860	0.2909	0.8389	158.85	16.13
0.1010	0.3416	0.8632	186.55	16.60
0.1160	0.3924	0.8835	214.26	16.98
0.1360	0.4600	0.9079	251.20	17.45
0.1560	0.5277	0.9298	288.14	17.87
0.1760	0.5953	0.9475	325.08	18.21
0.2010	0.6799	0.9639	371.27	18.53
0.2260	0.7645	0.9748	417.44	18.74
0.2610	0.8829	0.9852	482.09	18.94
0.3110	1.0520	0.9921	574.44	19.08
0.3760	1.2719	0.9968	694.50	19.16
0.4760	1.6101	0.9991	879.20	19.21
0.5760	1.9484	1.0000	1063.91	19.22

DATE 81568 RUN NO. 1

N= 7 X= 69.73 IN. UG= 69.65 FT/SEC REDELTA2= 1376.1

CF/2= 0.00250 VWALL/UG= -0.00395 K= 0.000E 00

VWALLPLUS= -0.0190 PPLUS= 0.00000

DEL= 0.368 IN. DELTA2= 0.0385 IN. H= 1.376

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0163	0.4195	10.62	8.39
0.0070	0.0190	0.4635	12.39	9.27
0.0080	0.0218	0.5023	14.17	10.05
0.0090	0.0245	0.5344	15.93	10.69
0.0100	0.0272	0.5589	17.70	11.19
0.0110	0.0299	0.5756	19.48	11.51
0.0120	0.0326	0.5915	21.25	11.83
0.0140	0.0381	0.6141	24.79	12.29
0.0160	0.0435	0.6304	28.32	12.62
0.0190	0.0517	0.6467	33.64	12.94
0.0230	0.0626	0.6665	40.73	13.33
0.0280	0.0762	0.6802	49.57	13.61
0.0360	0.0979	0.7010	63.74	14.03
0.0460	0.1251	0.7211	81.44	14.43
0.0560	0.1523	0.7395	99.14	14.79
0.0680	0.1850	0.7580	120.39	15.17
0.0810	0.2203	0.7767	143.43	15.54
0.0960	0.2611	0.7978	169.96	15.96
0.1110	0.3019	0.8159	196.52	16.32
0.1310	0.3563	0.8385	231.93	16.78
0.1560	0.4243	0.8654	276.19	17.31
0.1810	0.4923	0.8883	320.45	17.77
0.2060	0.5603	0.9094	364.71	18.20
0.2310	0.6283	0.9288	408.98	18.58
0.2560	0.6964	0.9470	453.24	18.95
0.2810	0.7644	0.9621	497.50	19.25
0.3060	0.8324	0.9728	541.76	19.46
0.3460	0.9412	0.9863	612.58	19.73
0.3960	1.0772	0.9945	701.10	19.91
0.4560	1.2404	0.9970	807.33	19.95
0.5310	1.4444	0.9993	940.12	19.99
0.6060	1.6484	0.9998	1072.39	20.00
0.6810	1.8524	1.0000	1205.68	20.01

DATE 81568 RUN NO. 1

N= 8 X= 85.78 IN. UG= 69.31 FT/SEC REDELTA2= 2104.

CF/2= 0.00230 VWALL/UG= -0.00394 K= 0.000E 00

VWALLPLUS= -0.0195 PPLUS= 0.00000

DEL= 0.541 IN. DELTA2= 0.0597 IN. H= 1.350

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0111	0.3880	10.15	8.09
0.0070	0.0129	0.4231	11.83	8.82
0.0080	0.0148	0.4711	13.53	9.82
0.0090	0.0166	0.4948	15.22	10.32
0.0100	0.0185	0.5183	16.91	10.81
0.0120	0.0222	0.5528	20.29	11.53
0.0140	0.0259	0.5768	23.67	12.02
0.0170	0.0314	0.6029	28.75	12.57
0.0210	0.0388	0.6246	35.50	13.02
0.0260	0.0480	0.6415	43.96	13.37
0.0320	0.0591	0.6581	54.10	13.72
0.0400	0.0739	0.6759	67.63	14.09
0.0500	0.0923	0.6926	84.54	14.44
0.0650	0.1200	0.7149	109.90	14.90
0.0850	0.1570	0.7399	143.71	15.43
0.1050	0.1939	0.7611	177.53	15.87
0.1250	0.2309	0.7796	211.34	16.25
0.1450	0.2678	0.7967	245.16	16.61
0.1700	0.3140	0.8150	287.43	16.99
0.1950	0.3601	0.8340	329.70	17.38
0.2300	0.4248	0.8574	388.88	17.87
0.2700	0.4986	0.8808	456.51	18.36
0.3200	0.5910	0.9082	541.05	18.93
0.3700	0.6833	0.9333	625.58	19.46
0.4200	0.7757	0.9556	710.13	19.92
0.4700	0.8680	0.9720	794.66	20.28
0.5450	1.0065	0.9909	921.47	20.65
0.6200	1.1450	0.9977	1048.28	20.80
0.6950	1.2835	0.9998	1175.09	20.84
0.7950	1.4682	1.0000	1344.16	20.85

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	F x 10^3	K x 10^6	RE_{δ_2}	H	K(H+1)RE_{δ_2}-F	$C_f/2 \times 10^3$ MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$ SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$ BEST ESTIMATE	$\frac{(\Delta_2)_P-(\Delta_2)_{ST}}{(\Delta_2)_{ST}} \times 100$
52868/5	±0.02	±0.09	±0.02	±9%	±4.7%	±0.07	±0.10	±0.15	±0.25		±20.0
M = 1	29.90	41.08	-2.02	0.0	905	1.307	--	--	3.43	3.43	11.0
M = 2	53.86	49.66	-1.98	0.570	909	1.271	3.16	2.97	3.19	3.10	10.9
M = 3	66.83	60.65	-1.96	0.567	840	1.289	3.05	2.85	2.96	2.96	9.5
M = 4	77.79	75.12	-2.01	0.599	762	1.326	3.07	2.99	2.81	2.99	9.3
M = 5	85.79	91.35	-2.04	0.573	734	1.347	3.02	2.93	2.86	3.02	
52768/5	±0.02	±0.12	±0.02	±14%	±8.0%	±0.12	±0.20	±0.30	±0.25		±22.0
M = 1	29.90	30.34	-2.00	0.0	615	1.352	--	--	3.71	3.55	15.5
M = 2	53.86	36.58	-1.98	0.739	676	1.307	3.13	2.97	3.52	3.30	1.7
M = 3	66.83	44.80	-1.98	0.761	630	1.324	3.09	2.92	3.22	3.22	5.0
M = 4	77.79	55.54	-1.99	0.808	579	1.342	3.09	3.07	3.25	3.25	-10.0
M = 5	85.79	67.66	-2.01	0.775	573	1.368	3.06	3.03	3.04	3.06	
80768/8	±0.02	±0.12	±0.02	±10%	±8.5%	±0.12	±0.25	±0.40	±0.25		±18.0
M = 1	13.78	25.18	-2.00	0.0	667	1.397	--	--	3.53	3.53	-11.0
M = 2	29.67	30.50	-1.99	1.41	622	1.333	4.03	3.09	3.53	3.40	-4.0
M = 3	37.69	37.08	-2.01	1.42	495	1.362	3.67	3.13	3.46	3.30	-6.6
M = 4	45.64	47.54	-2.02	1.53	399	1.435	3.51	3.06	3.23	3.23	-5.2
M = 5	49.63	55.36	-2.05	1.51	353	1.503	3.38	2.93	3.10	3.10	-2.6
M = 6	61.77	68.41	-2.00	0.0	427	1.509	--	--	2.65	3.15	3.6
M = 7	69.70	68.62	-2.00	0.0	674	1.393	--	--	2.82	3.30	6.1
M = 8	85.78	68.73	-1.98	0.0	1160	1.340	--	--	2.59	2.90	11.1

SETUP DATA

VWALL/UG= -0.002

RUN:	52868-1	52768-1	80768-1
PBARO (IN. HG) =	29.82	29.79	29.67
TAMBIENT (DEG-F) =	76.9	79.3	78.8
RELATIVE HUMIDITY =	0.45	0.45	0.45
TGAS (DEG-F) =	69.72	68.95	66.51
GAS DENSITY (LBM/FT3) =	0.0745	0.0743	0.0747
GAS VISCOSITY (FT2/SEC) =	0.164E-03	0.164E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	40.98	-0.00610	30.43	-0.00449	25.34	-0.00373
3.953	40.87		30.43		25.34	
5.953	40.88	-0.00610	30.43	-0.00447	25.30	-0.00374
7.961	40.88		30.43		25.27	
9.969	40.91	-0.00610	30.41	-0.00445	25.25	-0.00375
11.953	40.89		30.45		25.18	
13.937	40.88	-0.00625	30.45	-0.00446	25.18	-0.00376
15.945	40.88		30.45		25.19	
17.953	40.89	-0.00612	30.45	-0.00447	25.34	-0.00376
19.922	40.95		30.42		25.54	
21.938	40.99	-0.00609	30.37	-0.00448	26.21	-0.00388
23.954	40.88		30.30		27.00	
25.962	40.94	-0.00607	30.34	-0.00445	27.96	-0.00416
27.962	40.91		30.34		28.94	
29.978	40.90	-0.00618	30.34	-0.00451	30.27	-0.00453
31.939	40.94		30.35		31.58	
33.955	41.04	-0.00615	30.45	-0.00448	33.17	-0.00503
35.955	41.13		30.52		34.94	
37.971	41.48	-0.00614	30.67	-0.00454	36.83	-0.00555
39.987	42.05		31.18		38.91	
41.963	42.68	-0.00649	31.78	-0.00472	41.47	-0.00624
43.963	43.67		32.41		44.23	
45.963	44.63	-0.00671	33.10	-0.00491	47.51	-0.00717
47.979	45.70		33.87		51.32	
49.979	47.03	-0.00698	34.72	-0.00513	55.61	-0.00845
51.979	48.32		35.80		60.88	
53.995	49.76	-0.00733	36.79	-0.00537	66.18	-0.01002
55.971	51.18		37.82		67.83	
57.971	52.78	-0.00782	38.99	-0.00581	67.72	-0.01022
59.955	54.49		40.24		67.76	
61.979	56.19	-0.00827	41.61	-0.00612	67.68	-0.01022
63.971	57.96		42.86		67.72	
65.979	59.94	-0.00885	44.31	-0.00658	67.75	-0.01035
67.963	62.07		45.85		67.83	
69.971	64.38	-0.00951	47.58	-0.00697	67.78	-0.01022
71.979	66.86		49.46		67.71	
73.963	69.57	-0.01028	51.42	-0.00758	67.78	-0.01016
75.939	72.42		53.50		67.62	
77.947	75.75	-0.01124	55.95	-0.00821	67.63	-0.01020
79.939	79.41		58.64		67.58	
81.931	83.49	-0.01245	61.60	-0.00888	67.63	-0.01022
83.962	87.81		64.79		67.63	
85.931	92.47	-0.01381	68.19	-0.01006	67.63	-0.01014
87.915	97.62		72.00		67.64	
89.939	103.34	-0.01529	76.11	-0.01118	67.65	-0.01008
91.931	109.72		80.82		67.83	
93.947	116.78	-0.01726	86.05	-0.01262	67.96	-0.01026

DATE 52858 RUN NO. 1

X= 1 X= 25.90 IN. UG= 41.[illegible] FT/SEC REDELTA2= [illegible]5.3

CF/2= 0.00343 VWALL/UG= -0.00232 K= [illegible]

VWALLPLUS= -0.0[illegible]45 PPLUS= [illegible]

DEL= 0.570 IN. DELTA2= 0.0434 IN. H= 1.317

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0105	0.3936	7.33	6.67
0.0070	0.0123	0.4216	9.56	7.20
0.0080	0.0140	0.4621	9.78	7.90
0.0090	0.0154	0.4900	11.[illegible]	8.37
0.0100	0.0176	0.5246	12.22	8.95
0.0110	0.0193	0.5513	13.45	9.41
0.0120	0.0211	0.5760	14.67	9.74
0.0130	0.0228	0.5859	15.89	10.[illegible]6
0.0140	0.0246	0.6094	17.11	10.41
0.0160	0.0281	0.6339	19.57	10.82
0.0180	0.0316	0.6596	22.01	11.26
0.0200	0.0351	0.6755	24.45	11.53
0.0220	0.0386	0.6881	25.90	11.75
0.0250	0.0439	0.7062	30.57	12.[illegible]6
0.0290	0.0509	0.7220	35.46	12.35
0.0340	0.0597	0.7392	41.57	12.62
0.0420	0.0737	0.7604	51.35	12.99
0.0520	0.0913	0.7768	63.59	13.27
0.0670	0.1176	0.7962	81.91	13.59
0.0870	0.1528	0.8176	106.37	13.96
0.1120	0.1967	0.8439	135.94	14.42
0.1520	0.2669	0.8763	185.84	14.96
0.1820	0.3196	0.8943	222.52	15.27
0.2170	0.3810	0.9141	265.31	15.61
0.2570	0.4513	0.9328	314.22	15.93
0.3020	0.5303	0.9469	363.24	16.17
0.3620	0.6356	0.9563	442.57	16.51
0.4420	0.7761	0.9799	541.41	16.74
0.5120	0.8[illegible]41	0.98[illegible]	6[illegible].45	16.87
0.6320	1.1097	[illegible]	772.71	16.[illegible]
0.7320	1.2853	0.996[illegible]	89[illegible].97	17.[illegible]1
0.8320	1.4609	0.9987	1017.24	17.[illegible]5
0.9320	1.6365	1.0[illegible]	1139.5[illegible]	17.[illegible]7

DATE 52868 RUN NO. 1

X= 2 X= 53.86 IN. UG= 49.66 FT/SEC REDELTA2= 909.2

CF/2= 0.00319 VWALL/UG= -0.00199 K= 0.57[illegible]E-

VWALLPLUS= -0.0355 PPLUS= -0.00330

DEL= 0.561 IN. DELTA2= 0.0360 IN. H= 1.271

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0065	0.0117	0.4195	8.43	7.56
0.0070	0.0125	0.4467	9.83	8.27
0.0080	0.0143	0.5058	11.24	9.08
0.0090	0.0160	0.5438	12.65	9.77
0.0100	0.0178	0.5778	14.05	10.37
0.0110	0.0196	0.6039	15.46	10.94
0.0120	0.0214	0.6314	16.87	11.32
0.0130	0.0232	0.6516	18.27	11.70
0.0140	0.0250	0.6688	19.68	11.97
0.0150	0.0267	0.6809	21.08	12.23
0.0170	0.0303	0.7077	23.89	12.71
0.0190	0.0339	0.7275	26.70	13.05
0.0210	0.0374	0.7446	29.51	13.37
0.0240	0.0428	0.7620	33.72	13.68
0.0270	0.0481	0.7774	37.94	13.96
0.0310	0.0553	0.7924	43.57	14.23
0.0360	0.0642	0.8072	50.59	14.50
0.0420	0.0749	0.8194	59.03	14.71
0.0500	0.0891	0.8337	70.27	14.97
0.0600	0.1070	0.8467	84.32	15.21
0.0720	0.1284	0.8586	101.18	15.41
0.0860	0.1533	0.8710	120.86	15.64
0.1060	0.1890	0.8838	148.97	15.87
0.1360	0.2425	0.9027	191.13	16.21
0.1760	0.3138	0.9191	247.35	16.51
0.2260	0.4029	0.9363	317.61	16.81
0.2960	0.5277	0.9537	415.98	17.13
0.3660	0.6526	0.9687	514.36	17.40
0.4660	0.8309	0.9821	654.89	17.63
0.5660	1.0091	0.9904	795.43	17.79
0.6660	1.1874	0.9959	935.96	17.89
0.7660	1.3657	0.9977	1076.51	17.92
0.8660	1.5440	0.9991	1217.06	17.94
0.9660	1.7223	1.0000	1357.57	17.96

DATE 52858 RUN NO. 1

X= 3 X= 68.83 IN. UG= 6[illegible].65 FT/SEC REDELTA2= 839.7

CF/2= 0.00295 VWALL/UG= -0.00196 K= [illegible].567E-06

VWALLPLUS= -0.036[illegible] PPLUS= -0.00352

DEL= 0.478 IN. DELTA2= 0.0273 IN. H= 1.299

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0126	0.4516	1[illegible].05	[illegible]	0.669
0.0070	0.0147	0.5065	11.73	9.32	0.628
0.0080	0.0167	0.5546	13.40	10.19	0.593
0.0090	0.0188	0.5907	15.07	10.[illegible]5	0.565
0.0100	0.0209	0.6[illegible]2	16.75	11.51	0.538
0.0110	0.0230	0.6631	18.43	12.19	0.510
0.0120	0.0251	0.6857	20.10	12.6[illegible]	0.493
0.0130	0.0272	0.6597	21.77	12.[illegible]5	0.480
0.0140	0.0293	0.7152	23.45	13.15	0.467
0.0160	0.0335	0.7378	26.80	13.56	0.447
0.0180	0.0377	0.7586	30.15	13.94	0.429
0.0200	0.0419	0.7733	33.5[illegible]	14.21	0.415
0.0220	0.0460	0.78[illegible]	36.85	14.4[illegible]	0.403
0.0250	0.0523	0.7966	41.88	14.64	0.389
0.0290	0.0607	0.8125	48.59	14.94	0.37[illegible]
0.0350	0.0733	0.8266	58.63	15.2[illegible]	[illegible]
0.0430	0.0900	0.8436	72.03	15.51	0.325
0.0550	0.1151	0.8591	92.12	15.80	0.297
0.0700	0.1465	0.8774	117.25	16.13	0.265
0.0900	0.1883	0.8973	150.76	16.5[illegible]	0.229
0.1150	0.2407	0.9161	192.63	16.86	0.195
0.1450	0.3035	0.9330	242.89	17.17	0.162
0.1850	0.3472	0.9478	309.89	17.42	0.13[illegible]
0.2350	0.4919	0.9628	393.65	17.73	0.10[illegible]
0.3150	0.6593	0.9753	519.27	17.93	0.077
0.3950	0.8259	0.9836	6[illegible].[illegible]	18.[illegible]8	0.055
0.4950	1.0352	0.9905	812.41	18.21	0.042
0.5850	1.2245	0.9951	[illegible]79.[illegible]2	18.29	0.036
0.6850	1.4339	0.9976	1147.42	18.34	0.034
0.7850	1.6431	0.9974	1314.34	18.37	0.034
0.8850	1.8524	1.0[illegible]	1482.45	18.38	0.034

DATE 52868 RUN NO. 1

X= 4 X= 77.79 IN. UG= 75.12 FT/SEC REDELTA2= 762.3

CF/2= 0.00299 VWALL/UG= -0.00231 K= 0.599E-06

VWALLPLUS= -0.0[illegible]368 PPLUS= -0.00367

DEL= 0.339 IN. DELTA2= 0.0203 IN. H= 1.326

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0177	0.5163	12.49	9.33	0.61[illegible]
0.0070	0.0206	0.5459	14.53	10.[illegible]4	0.585
0.0080	0.0236	0.5995	16.67	10.96	0.546
0.0090	0.0265	0.6567	18.74	11.90	0.507
0.0100	0.0295	0.6840	20.83	12.51	0.481
0.0110	0.0324	0.7041	22.91	12.88	0.463
0.0120	0.0354	0.7249	25.00	13.26	0.446
0.0130	0.0383	0.7371	27.08	13.49	0.434
0.0150	0.0442	0.7631	31.25	13.96	0.413
0.0170	0.0501	0.7816	35.41	14.30	0.392
0.0190	0.0560	0.7940	39.53	14.52	0.378
0.0220	0.0648	0.8101	45.83	14.82	0.359
0.0260	0.0766	0.8232	54.16	15.06	0.340
0.0310	0.0913	0.8376	64.57	15.33	0.319
0.0380	0.1120	0.8526	79.15	15.60	0.294
0.0470	0.1385	0.8688	97.89	15.89	0.266
0.0580	0.1709	0.8835	120.81	16.16	0.238
0.0710	0.2092	0.9002	147.89	16.47	0.207
0.0840	0.2475	0.9140	174.97	16.72	0.181
0.0990	0.2917	0.9264	206.23	16.95	0.157
0.1190	0.3506	0.9396	247.87	17.18	0.132
0.1390	0.4095	0.9503	289.52	17.38	0.108
0.1640	0.4832	0.9605	341.63	17.57	0.086
0.1940	0.5716	0.9701	404.08	17.74	0.066
0.2340	0.6895	0.9775	487.4[illegible]	17.88	0.047
0.2840	0.8368	0.9850	591.54	18.02	0.030
0.3440	1.0136	0.9904	716.52	18.11	0.017
0.4040	1.1903	0.9934	841.53	18.17	0.009
0.4690	1.3818	0.9962	976.88	18.22	0.004
0.5440	1.6029	0.9974	1133.10	18.24	0.000
0.6190	1.8238	0.9996	1289.32	18.29	-0.002
0.6940	2.0448	0.9998	1445.53	18.29	-0.002
0.7690	2.2659	1.0000	1601.76	18.29	-0.002

DATE 52768 RUN NO. 1

M= 5 X= 85.79 IN. UG= 91.35 FT/SEC REDELTA2= 733.7

CF/2= 0.00302 VWALL/UG= -0.00204 K= 0.573E-06

VWALLPLUS= -0.0370 PPLUS= -0.00345

DEL= 0.257 IN. DELTA2= 0.0159 IN. H= 1.347

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0233	0.5948	15.26	10.82	0.556
0.0070	0.0272	0.6466	17.80	11.76	0.516
0.0080	0.0311	0.6866	20.34	12.49	0.484
0.0090	0.0350	0.7176	22.89	13.05	0.459
0.0100	0.0389	0.7389	25.43	13.44	0.441
0.0110	0.0428	0.7542	27.97	13.72	0.427
0.0120	0.0466	0.7661	30.51	13.94	0.415
0.0140	0.0544	0.7863	35.60	14.30	0.395
0.0160	0.0622	0.7987	40.69	14.53	0.380
0.0190	0.0738	0.8156	48.32	14.84	0.360
0.0230	0.0894	0.8292	58.49	15.08	0.340
0.0290	0.1127	0.8457	73.74	15.39	0.313
0.0370	0.1438	0.8634	94.10	15.70	0.284
0.0470	0.1827	0.8806	119.52	16.02	0.252
0.0590	0.2293	0.8994	150.03	16.37	0.218
0.0720	0.2798	0.9158	183.09	16.66	0.189
0.0850	0.3304	0.9285	216.15	16.89	0.165
0.1000	0.3887	0.9419	254.30	17.14	0.141
0.1180	0.4586	0.9536	300.08	17.34	0.120
0.1390	0.5402	0.9647	353.48	17.55	0.100
0.1640	0.6374	0.9734	417.05	17.71	0.082
0.1930	0.7501	0.9806	490.81	17.83	0.068
0.2250	0.8745	0.9869	572.19	17.95	0.057
0.2600	1.0105	0.9903	661.19	18.01	0.049
0.3000	1.1660	0.9930	762.91	18.07	0.043
0.3500	1.3603	0.9957	890.07	18.12	0.037
0.4000	1.5546	0.9973	1017.21	18.15	0.034
0.4500	1.7490	0.9980	1144.37	18.16	0.032
0.5250	2.0404	0.9985	1335.09	18.17	0.030
0.6000	2.3319	0.9996	1525.82	18.19	0.029
0.6750	2.6234	1.0000	1714.55	18.20	0.029

DATE 52768 RUN NO. 1

M= 1 X= 29.96 IN. UG= 33.34 FT/SEC REDELTA2= 615.2

CF/2= 0.00355 VWALL/UG= -0.00230 K= 0.0 E 00

VWALLPLUS= -0.0386 PPLUS= 0.00000

DEL= 0.480 IN. DELTA2= 0.0433 IN. H= 1.352

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0125	0.3118	5.50	5.24
0.0070	0.0146	0.3593	6.42	6.03
0.0080	0.0167	0.3889	7.34	6.52
0.0090	0.0187	0.4367	8.25	7.33
0.0100	0.0208	0.4474	9.17	7.51
0.0110	0.0229	0.4814	10.09	8.08
0.0120	0.0250	0.5061	11.00	8.49
0.0140	0.0292	0.5499	12.83	9.23
0.0160	0.0333	0.5885	14.66	9.87
0.0180	0.0375	0.6208	16.50	10.42
0.0200	0.0417	0.6344	18.34	10.65
0.0230	0.0479	0.6644	21.08	11.15
0.0260	0.0542	0.6996	23.83	11.58
0.0290	0.0604	0.7054	26.58	11.84
0.0330	0.0687	0.7258	30.25	12.19
0.0370	0.0771	0.7375	33.91	12.37
0.0420	0.0875	0.7571	38.50	12.71
0.0510	0.1062	0.7730	46.75	12.99
0.0620	0.1292	0.7948	56.83	13.34
0.0770	0.1604	0.8190	70.58	13.74
0.0920	0.1917	0.8308	84.33	13.95
0.1120	0.2333	0.8497	102.66	14.25
0.1320	0.2750	0.8625	120.99	14.48
0.1570	0.3271	0.8848	143.91	14.85
0.1820	0.3792	0.9066	166.82	15.21
0.2070	0.4312	0.9147	189.74	15.35
0.2420	0.5041	0.9357	221.82	15.71
0.2820	0.5875	0.9525	258.49	15.99
0.3320	0.6916	0.9640	304.32	16.18
0.3820	0.7958	0.9790	350.15	16.43
0.4320	0.9000	0.9853	395.99	16.54
0.4820	1.0041	0.9902	441.81	16.62
0.5570	1.1604	0.9927	510.56	16.66
0.6320	1.3166	0.9951	579.31	16.70
0.7070	1.4729	0.9967	648.06	16.72
0.7820	1.6291	0.9976	716.80	16.74
0.8570	1.7854	0.9988	785.56	16.76
0.9320	1.9416	1.0000	854.30	16.78

DATE 52768 RUN NO. 1

M= 2 X= 53.86 IN. UG= 36.58 FT/SEC REDELTA2= 676.1

CF/2= 0.00330 VWALL/UG= -0.00198 K= 0.739E-06

VWALLPLUS= -0.0344 PPLUS= -0.00391

DEL= 0.557 IN. DELTA2= 0.0365 IN. H= 1.307

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0108	0.3499	6.39	6.10
0.0070	0.0126	0.3948	7.45	6.88
0.0080	0.0144	0.4372	8.51	7.61
0.0090	0.0161	0.4723	9.58	8.22
0.0100	0.0179	0.5049	10.64	8.80
0.0110	0.0197	0.5245	11.71	9.14
0.0130	0.0233	0.5792	13.84	10.09
0.0150	0.0269	0.6225	15.97	10.84
0.0170	0.0305	0.6566	18.10	11.44
0.0190	0.0341	0.6829	20.23	11.90
0.0210	0.0377	0.7023	22.36	12.23
0.0230	0.0413	0.7246	24.49	12.62
0.0250	0.0448	0.7373	26.61	12.84
0.0280	0.0502	0.7541	29.81	13.14
0.0310	0.0555	0.7708	33.00	13.42
0.0350	0.0628	0.7900	37.26	13.76
0.0410	0.0735	0.8068	43.65	14.05
0.0490	0.0879	0.8233	52.17	14.34
0.0590	0.1058	0.8394	62.81	14.62
0.0710	0.1274	0.8533	75.59	14.86
0.0860	0.1543	0.8670	91.56	15.10
0.1060	0.1901	0.8814	112.84	15.35
0.1310	0.2350	0.8955	139.46	15.60
0.1660	0.2978	0.9132	176.73	15.91
0.2060	0.3695	0.9277	219.33	16.16
0.2660	0.4771	0.9457	283.19	16.47
0.3360	0.6027	0.9624	357.71	16.76
0.4360	0.7821	0.9788	464.17	17.05
0.5360	0.9615	0.9882	570.63	17.22
0.6360	1.1408	0.9966	677.09	17.36
0.7360	1.3202	0.9992	783.55	17.40
0.8360	1.4996	1.0000	890.01	17.41

DATE 52768 RUN NO. 1

M= 3 X= 66.83 IN. UG= 44.90 FT/SEC REDELTA2= 633.3

CF/2= 0.00322 VWALL/UG= -0.00198 K= 0.761E-06

VWALLPLUS= -0.0349 PPLUS= -0.00417

DEL= 0.480 IN. DELTA2= 0.0278 IN. H= 1.324

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0070	0.0146	0.4331	9.02	7.63	0.703
0.0080	0.0167	0.4785	10.31	8.44	0.668
0.0090	0.0188	0.5359	11.59	9.45	0.629
0.0100	0.0208	0.5692	12.88	10.03	0.605
0.0110	0.0229	0.5886	14.18	10.37	0.589
0.0130	0.0271	0.6432	16.75	11.34	0.549
0.0150	0.0313	0.6804	19.33	11.99	0.521
0.0170	0.0354	0.7101	21.91	12.52	0.498
0.0190	0.0396	0.7364	24.47	12.98	0.477
0.0210	0.0438	0.7530	27.06	13.27	0.462
0.0240	0.0500	0.7728	30.92	13.62	0.444
0.0280	0.0583	0.7963	36.09	14.03	0.422
0.0330	0.0688	0.8130	42.52	14.32	0.403
0.0400	0.0833	0.8340	51.53	14.70	0.378
0.0480	0.1000	0.8527	61.84	15.02	0.356
0.0580	0.1208	0.8644	74.73	15.24	0.335
0.0730	0.1521	0.8798	94.05	15.51	0.307
0.0930	0.1938	0.8993	119.82	15.85	0.275
0.1130	0.2354	0.9128	145.59	16.09	0.250
0.1380	0.2875	0.9267	177.79	16.32	0.224
0.1680	0.3500	0.9398	216.45	16.54	0.199
0.2030	0.4229	0.9513	261.54	16.76	0.174
0.2430	0.5063	0.9629	313.07	16.97	0.153
0.2880	0.6000	0.9716	371.05	17.12	0.136
0.3330	0.6938	0.9762	429.02	17.20	0.123
0.3830	0.7979	0.9842	493.44	17.34	0.113
0.4580	0.9542	0.9887	590.07	17.41	0.102
0.5330	1.1105	0.9944	686.69	17.52	0.097
0.6080	1.2667	0.9966	783.32	17.56	0.094
0.6830	1.4230	0.9978	879.95	17.58	0.092
0.7580	1.5792	0.9989	976.57	17.60	0.092
0.8330	1.7355	0.9994	1073.20	17.61	0.092
0.9080	1.8918	1.0000	1169.82	17.62	0.092

DATE 52768 RUN NO. 1

H= 4 X= 77.79 IN. UG= 55.94 FT/SEC REDELTA2= 578.5

CF/2= 0.00325 VWALL/UG= -0.00149 K= 0.898E-06

VWALLPLUS= -0.0349 PPLUS= -0.00[illegible]

DEL= 0.353 IN. DELTA2= 0.0206 IN. H= 1.342

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0170	0.4552	9.62	7.79	0.683
0.0070	0.0198	0.5153	11.22	9.04	0.641
0.0080	0.0227	0.5620	12.82	9.96	0.608
0.0090	0.0255	0.6044	14.43	10.61	0.577
0.0100	0.0283	0.6402	16.03	11.23	0.551
0.0110	0.0312	0.6647	17.63	11.66	0.532
0.0120	0.0340	0.6858	19.24	12.03	0.515
0.0140	0.0397	0.7205	22.44	12.64	0.487
0.0160	0.0453	0.7492	25.65	13.15	0.463
0.0180	0.0510	0.7680	28.86	13.48	0.445
0.0210	0.0595	0.7857	33.66	13.84	0.424
0.0240	0.0680	0.8091	38.47	14.20	0.404
0.0280	0.0793	0.8260	44.89	14.49	0.385
0.0330	0.0935	0.8422	52.90	14.78	0.364
0.0390	0.1105	0.8572	62.52	15.04	0.344
0.0470	0.1332	0.8719	75.34	15.30	0.320
0.0570	0.1615	0.8840	91.37	15.51	0.297
0.0690	0.1955	0.8987	110.61	15.77	0.271
0.0820	0.2324	0.9104	131.45	15.97	0.248
0.0970	0.2749	0.9231	155.50	16.20	0.223
0.1120	0.3174	0.9325	179.54	16.36	0.203
0.1320	0.3741	0.9449	211.60	16.58	0.179
0.1520	0.4307	0.9534	243.67	16.73	0.160
0.1770	0.5016	0.9617	283.74	16.88	0.141
0.2070	0.5866	0.9700	331.83	17.02	0.122
0.2420	0.6858	0.9775	387.94	17.15	0.106
0.2770	0.7850	0.9835	444.05	17.26	0.093
0.3270	0.9266	0.9879	524.20	17.33	0.081
0.3770	1.0683	0.9920	604.36	17.41	0.071
0.4270	1.2100	0.9934	684.51	17.43	0.066
0.5020	1.4226	0.9978	804.74	17.51	0.059
0.5770	1.6351	0.9993	924.97	17.53	0.057
0.6520	1.8476	0.9996	1045.20	17.54	0.056
0.7270	2.0602	1.0000	1165.43	17.55	0.055

DATE 52768 RUN NO. 1

H= 5 X= 85.79 IN. UG= 67.66 FT/SEC REDELTA2= 573.1

CF/2= 0.00306 VWALL/UG= -0.00[illegible] K= 0.775E-06

VWALLPLUS= -0.0363 PPLUS= -0.0[illegible]458

DEL= 0.275 IN. DELTA2= 0.0167 IN. H= 1.368

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS	TAUPLUS
0.0060	0.0219	0.5037	11.36	[illegible]	0.625
0.0070	0.0255	0.5578	13.26	[illegible]	0.592
0.0080	0.0291	[illegible]	15.15	[illegible]	0.549
0.0090	0.0328	0.6455	17.04	11.68	0.514
0.0100	0.0364	0.6826	18.94	12.34	0.485
0.0110	0.0401	0.7122	20.83	[illegible]	0.461
0.0120	0.0437	0.7319	22.72	13.23	0.444
0.0130	0.0473	0.7474	24.62	13.42	0.430
0.0150	0.0546	0.7709	28.41	13.94	0.407
0.0170	0.0619	0.7888	32.19	14.26	0.389
0.0200	0.0728	0.8115	37.87	14.67	0.365
0.0240	0.0874	0.8300	45.45	15.[illegible]	0.341
0.0300	0.1093	0.8488	56.81	15.35	0.317
0.0380	0.1384	0.8660	71.96	15.66	0.284
0.0480	0.1748	0.8837	90.9[illegible]	15.98	0.252
0.0620	0.2256	0.9032	117.41	16.33	0.215
0.0780	0.2841	0.9199	147.71	16.63	0.181
0.0980	0.3569	0.9376	185.58	16.95	0.146
0.1180	0.4297	0.9501	223.46	17.18	0.12[illegible]
0.1430	0.5208	0.9609	270.80	17.37	0.094
0.1780	0.6482	0.9746	337.0[illegible]	17.62	0.067
0.2280	0.8303	0.9849	431.76	17.81	0.043
0.2780	1.0124	0.9904	526.45	17.91	0.029
0.3280	1.1945	0.9938	621.13	17.97	0.021
0.3780	1.3766	0.9956	715.81	18.00	0.015
0.4280	1.5586	0.9977	810.50	18.03	0.011
0.4780	1.7407	0.9988	905.18	18.06	0.009
0.5530	2.0139	0.9995	1047.21	18.07	0.007
0.6280	2.2873	1.0000	1189.24	18.08	0.007

DATE 83768 RUN NO. 1

H= 1 X= 13.78 IN. UG= 25.16 FT/SEC REDELTA2= 667.4

CF/2= 0.00353 VWALL/UG= -0.00200 K= 0.0000E 00

VWALLPLUS= -0.0337 PPLUS= 0.00000

DEL= 0.481 IN. DELTA2= 0.0518 IN. H= 1.397

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0070	0.0145	0.2894	5.36	4.89
0.0080	0.0166	0.3294	6.12	5.54
0.0090	0.0187	0.3631	6.89	6.11
0.0100	0.0208	0.3794	7.65	6.39
0.0110	0.0228	0.3931	8.41	6.62
0.0130	0.0270	0.4518	9.95	7.61
0.0150	0.0312	0.4799	11.47	8.28
0.0170	0.0353	0.5243	13.01	8.82
0.0190	0.0395	0.5442	14.54	9.16
0.0210	0.0436	0.5802	16.07	9.77
0.0230	0.0478	0.5964	17.60	10.04
0.0260	0.0540	0.6167	19.90	10.38
0.0300	0.0623	0.6500	22.96	10.95
0.0350	0.0727	0.6661	26.78	11.22
0.0450	0.0935	0.7071	34.43	11.91
0.0550	0.1142	0.7340	42.08	12.36
0.0700	0.1456	0.7553	53.55	12.71
0.0900	0.1870	0.7805	68.86	13.14
0.1150	0.2389	0.7992	87.99	13.45
0.1500	0.3116	0.8286	114.77	13.95
0.1850	0.3843	0.8475	141.54	14.27
0.2350	0.4882	0.8821	179.80	14.86
0.2850	0.5920	0.9116	218.05	15.35
0.3350	0.6959	0.9307	256.31	15.68
0.3850	0.7997	0.9568	294.56	16.11
0.4350	0.9036	0.9750	332.81	16.42
0.4850	1.0075	0.9912	371.07	16.69
0.5350	1.1113	0.9965	409.32	16.78
0.5850	1.2152	0.9982	447.58	16.81
0.6600	1.3710	1.0000	504.96	16.84

DATE 83768 RUN NO. 1

H= 2 X= 29.67 IN. UG= 30.50 FT/SEC REDELTA2= 622.3

CF/2= 0.00340 VWALL/UG= -0.00199 K= 0.141E-05

VWALLPLUS= -0.0341 PPLUS= -0.00710

DEL= 0.503 IN. DELTA2= 0.0399 IN. H= 1.333

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0119	0.3041	5.46	5.22
0.0070	0.0139	0.3343	6.37	5.73
0.0080	0.0159	0.3687	7.28	6.32
0.0090	0.0179	0.4066	8.19	6.96
0.0100	0.0199	0.4308	9.10	7.39
0.0120	0.0238	0.4866	10.92	8.35
0.0140	0.0278	0.5514	12.74	9.45
0.0160	0.0318	0.5810	14.56	9.97
0.0180	0.0358	0.6171	16.38	10.59
0.0200	0.0397	0.6475	18.19	11.11
0.0220	0.0437	0.6711	20.01	11.51
0.0250	0.0497	0.7009	22.74	12.03
0.0280	0.0556	0.7211	25.47	12.37
0.0320	0.0636	0.7505	29.10	12.87
0.0370	0.0735	0.7756	33.65	13.31
0.0430	0.0854	0.7925	39.11	13.60
0.0500	0.0993	0.8119	45.48	13.93
0.0600	0.1192	0.8266	54.57	14.14
0.0750	0.1490	0.8438	68.22	14.48
0.0950	0.1887	0.8649	86.41	14.84
0.1200	0.2383	0.8732	109.15	14.98
0.1550	0.3079	0.8935	140.99	15.33
0.2050	0.4072	0.9135	186.46	15.67
0.2550	0.5065	0.9265	231.93	15.89
0.3050	0.6058	0.9457	277.42	16.22
0.3550	0.7051	0.9571	322.90	16.42
0.4050	0.8044	0.9708	368.37	16.66
0.4550	0.9037	0.9787	413.85	16.79
0.5050	1.0030	0.9904	459.33	16.99
0.5550	1.1023	0.9947	504.81	17.07
0.6300	1.2513	0.9976	573.03	17.11
0.7050	1.4002	0.9988	641.25	17.13
0.7800	1.5492	1.0000	709.46	17.15

DATE 83768 RUN NO. 1

N= 3 X= 37.69 IN. UG= 37.09 FT/SEC REDELTA2= 494.7

CF/2= 0.00330 VWALL/UG= -0.00201 K= 0.142E-05

VWALLPLUS= -0.0349 PPLUS= -0.00750

DEL= 0.422 IN. DELTA2= [illegible] IN. H= 1.362

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0142	0.3466	6.53	6.03
0.0070	0.0166	0.3877	7.62	6.75
0.0080	0.0189	0.4210	8.71	7.33
0.0090	0.0213	0.4622	9.80	8.04
0.0100	0.0237	0.4961	10.89	8.64
0.0110	0.0260	0.5263	11.99	9.16
0.0120	0.0284	0.5621	13.08	9.78
0.0130	0.0308	0.5848	14.17	10.18
0.0150	0.0355	0.6354	16.35	11.06
0.0170	0.0403	0.6654	18.52	11.58
0.0190	0.0450	0.6999	20.70	12.18
0.0210	0.0497	0.7272	22.88	12.66
0.0230	0.0545	0.7525	25.06	13.09
0.0260	0.0616	0.7769	28.33	13.52
0.0300	0.0710	0.8016	32.68	13.96
0.0350	0.0829	0.8216	38.14	14.30
0.0410	0.0971	0.8412	44.67	14.64
0.0510	0.1208	0.8668	55.56	15.09
0.0610	0.1445	0.8789	66.46	15.30
0.0760	0.1800	0.8963	82.81	15.60
0.0960	0.2273	0.9167	104.59	15.95
0.1260	0.2984	0.9270	137.28	16.14
0.1660	0.3931	0.9423	180.87	16.40
0.2160	0.5115	0.9527	235.34	16.57
0.2660	0.6299	0.9644	289.81	16.78
0.3160	0.7483	0.9753	344.30	16.98
0.3660	0.8667	0.9828	398.77	17.10
0.4160	0.9851	0.9894	453.24	17.22
0.4910	1.1627	0.9967	534.96	17.35
0.5660	1.3403	0.9984	616.68	17.38
0.6410	1.5179	0.9997	698.40	17.40
0.7160	1.6955	1.0000	780.11	17.40

DATE 83768 RUN NO. 1

N= 4 X= 45.64 IN. UG= 47.54 FT/SEC REDELTA2= 399.4

CF/2= 0.00323 VWALL/UG= -0.00202 K= 0.193E-05

VWALLPLUS= -0.0356 PPLUS= -0.00931

DEL= 0.315 IN. DELTA2= 0.0144 IN. H= 1.433

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0065	0.0206	0.4234	8.98	7.45
0.0075	0.0238	0.4636	10.35	8.16
0.0085	0.0270	0.5074	11.74	8.93
0.0095	0.0301	0.5449	13.12	9.59
0.0105	0.0333	0.5936	14.50	10.45
0.0115	0.0365	0.6213	15.88	10.93
0.0125	0.0397	0.6508	17.26	11.45
0.0145	0.0460	0.6977	20.02	12.28
0.0165	0.0524	0.7323	22.78	12.89
0.0185	0.0587	0.7640	25.54	13.44
0.0205	0.0650	0.7851	28.31	13.81
0.0235	0.0746	0.8160	32.45	14.36
0.0265	0.0841	0.8357	36.59	14.71
0.0305	0.0968	0.8567	42.11	15.08
0.0355	0.1126	0.8840	49.02	15.56
0.0415	0.1317	0.8990	57.30	15.82
0.0495	0.1571	0.9105	68.35	16.02
0.0615	0.1951	0.9234	84.92	16.25
0.0815	0.2586	0.9404	112.54	16.55
0.1065	0.3379	0.9519	147.06	16.76
0.1365	0.4331	0.9622	188.49	16.94
0.1865	0.5917	0.9734	257.53	17.13
0.2365	0.7504	0.9815	326.57	17.27
0.2865	0.9090	0.9866	395.61	17.36
0.3365	1.0676	0.9926	464.65	17.47
0.3865	1.2263	0.9945	533.69	17.50
0.4615	1.4642	0.9975	637.26	17.55
0.5365	1.7022	1.0000	740.82	17.60

DATE 83768 RUN NO. 1

N= 5 X= 49.63 IN. UG= 55.36 FT/SEC REDELTA2= 353.4

CF/2= 0.00310 VWALL/UG= -0.00205 K= 0.151E-05

VWALLPLUS= -0.0368 PPLUS= -0.00874

DEL= 0.243 IN. DELTA2= 0.0125 IN. H= 1.503

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0065	0.0268	0.4558	10.24	8.19
0.0075	0.0309	0.4986	11.81	8.95
0.0085	0.0350	0.5400	13.39	9.69
0.0095	0.0391	0.6026	14.96	10.81
0.0105	0.0433	0.6367	16.55	11.44
0.0115	0.0474	0.6669	18.12	11.98
0.0125	0.0515	0.6904	19.70	12.40
0.0135	0.0556	0.7155	21.27	12.85
0.0145	0.0597	0.7336	22.85	13.17
0.0165	0.0680	0.7724	26.00	13.86
0.0185	0.0762	0.8002	29.15	14.37
0.0205	0.0845	0.8200	32.30	14.73
0.0235	0.0968	0.8472	37.02	15.21
0.0265	0.1092	0.8667	41.75	15.56
0.0305	0.1257	0.8875	48.05	15.93
0.0355	0.1463	0.9050	55.93	16.25
0.0425	0.1751	0.9206	66.95	16.53
0.0585	0.2410	0.9410	92.16	16.89
0.0835	0.3440	0.9564	131.55	17.18
0.1185	0.4882	0.9693	186.69	17.41
0.1685	0.6943	0.9805	265.46	17.61
0.2435	1.0033	0.9901	383.61	17.78
0.3185	1.3123	0.9966	501.76	17.89
0.3935	1.6213	0.9985	619.92	17.93
0.4685	1.9303	0.9996	738.08	17.95
0.5435	2.2393	1.0000	856.23	17.96

DATE 83768 RUN NO. 1

N= 6 X= 61.77 IN. UG= 68.41 FT/SEC REDELTA2= 426.5

CF/2= 0.00315 VWALL/UG= -0.00200 K= 0.000E 00

VWALLPLUS= -0.0357 PPLUS= 0.00000

DEL= 0.185 IN. DELTA2= 0.0122 IN. H= 1.509

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0325	0.4631	11.75	8.26
0.0070	0.0379	0.5017	13.71	8.95
0.0080	0.0433	0.5577	15.67	9.94
0.0090	0.0487	0.6006	17.63	10.71
0.0100	0.0541	0.6339	19.59	11.31
0.0110	0.0595	0.6645	21.54	11.84
0.0120	0.0650	0.6896	23.50	12.30
0.0130	0.0704	0.7091	25.47	12.64
0.0140	0.0758	0.7254	27.42	12.94
0.0160	0.0866	0.7519	31.34	13.41
0.0180	0.0974	0.7760	35.25	13.84
0.0200	0.1083	0.7943	39.17	14.16
0.0230	0.1245	0.8183	45.04	14.59
0.0270	0.1462	0.8413	52.88	15.00
0.0320	0.1732	0.8643	62.67	15.42
0.0390	0.2111	0.8859	76.39	15.80
0.0470	0.2544	0.9030	92.05	16.10
0.0570	0.3086	0.9216	111.64	16.44
0.0690	0.3735	0.9376	135.14	16.71
0.0820	0.4439	0.9507	160.61	16.96
0.0970	0.5251	0.9627	189.99	17.17
0.1170	0.6334	0.9733	229.16	17.35
0.1470	0.7958	0.9836	287.91	17.54
0.1970	1.0665	0.9921	385.85	17.69
0.2470	1.3371	0.9950	483.78	17.74
0.2970	1.6078	0.9978	581.71	17.79
0.3470	1.8785	0.9990	679.64	17.82
0.4220	2.2845	0.9998	826.55	17.83
0.4970	2.6905	1.0000	973.44	17.83

DATE 80768 RUN NO. 1

R= 7 X= 69.70 IN. UG= 68.62 FT/SEC REDELTA2= 673.7

CF/2= 0.00330 VWALL/UG= -0.00200 K= 0.000E 00

VWALLPLUS= -0.0348 PPLUS= 0.00000

DEL= 0.229 IN. DELTA2= 0.0192 IN. H= 1.373

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0262	0.4901	12.08	8.52
0.0070	0.0305	0.5412	14.10	9.41
0.0080	0.0349	0.5924	16.11	10.31
0.0090	0.0393	0.6255	18.12	10.88
0.0100	0.0436	0.6556	20.14	11.40
0.0110	0.0480	0.6766	22.16	11.77
0.0120	0.0524	0.6891	24.17	11.99
0.0140	0.0611	0.7119	28.19	12.38
0.0170	0.0742	0.7371	34.24	12.82
0.0200	0.0873	0.7540	40.28	13.11
0.0240	0.1047	0.7721	48.34	13.43
0.0300	0.1309	0.7906	60.42	13.75
0.0380	0.1658	0.8105	76.53	14.10
0.0500	0.2182	0.8365	100.70	14.55
0.0650	0.2837	0.8619	130.91	14.99
0.0800	0.3491	0.8867	161.12	15.43
0.0950	0.4146	0.9065	191.33	15.77
0.1100	0.4801	0.9237	221.54	16.07
0.1300	0.5673	0.9430	261.81	16.40
0.1500	0.6546	0.9600	302.10	16.70
0.1750	0.7637	0.9740	352.45	16.94
0.2000	0.8728	0.9830	402.80	17.10
0.2350	1.0256	0.9914	473.29	17.25
0.2750	1.2001	0.9950	553.85	17.30
0.3250	1.4183	0.9974	654.54	17.35
0.3750	1.6365	0.9983	755.25	17.37
0.4500	1.9638	0.9993	906.30	17.38
0.5250	2.2911	1.0000	1057.34	17.40

DATE 80768 RUN NO. 1

R= 8 X= 85.78 IN. UG= 68.73 FT/SEC REDELTA2= 1160.3

CF/2= 0.00290 VWALL/UG= -0.00198 K= 0.000E 00

VWALLPLUS= -0.0368 PPLUS= 0.00000

DEL= 0.349 IN. DELTA2= 0.0331 IN. H= 1.340

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0172	0.4545	11.34	8.43
0.0070	0.0200	0.4949	13.23	9.19
0.0080	0.0229	0.5437	15.11	10.09
0.0090	0.0258	0.5816	17.01	10.80
0.0100	0.0286	0.6039	18.90	11.21
0.0120	0.0343	0.6394	22.67	11.87
0.0140	0.0401	0.6616	26.45	12.29
0.0170	0.0486	0.6889	32.12	12.79
0.0200	0.0572	0.7056	37.79	13.10
0.0240	0.0687	0.7225	45.35	13.41
0.0300	0.0858	0.7400	56.69	13.74
0.0390	0.1116	0.7590	73.69	14.09
0.0540	0.1545	0.7847	102.03	14.57
0.0690	0.1975	0.8062	130.38	14.97
0.0890	0.2547	0.8302	168.17	15.42
0.1140	0.3262	0.8549	215.40	15.88
0.1390	0.3978	0.8774	262.64	16.30
0.1640	0.4693	0.8979	309.89	16.68
0.1940	0.5551	0.9190	366.57	17.07
0.2240	0.6410	0.9389	423.26	17.43
0.2540	0.7268	0.9557	479.94	17.75
0.2840	0.8127	0.9697	536.63	18.00
0.3140	0.8985	0.9818	593.31	18.23
0.3440	0.9844	0.9890	650.00	18.37
0.3740	1.0702	0.9943	706.68	18.46
0.4140	1.1847	0.9979	782.26	18.53
0.4640	1.3278	0.9991	876.74	18.55
0.5390	1.5424	1.0000	1019.46	18.57

DATE/NO. X STATIONS	X, IN.	U_∞, FT./SEC.	F x 10^3	K x 10^6	RE_{δ_2}	H	K(H+1)RE_{δ_2}-F	$C_f/2 \times 10^3$: MOMENTUM INTEGRAL EQUATION	$C_f/2 \times 10^3$: SUBLAYER (2 PTS.)	$C_f/2 \times 10^3$: BEST ESTIMATE
60168/5	±0.02	±0.09	±0.02	±10%	±15%	±0.22	±0.05	±0.10	±0.30	
M = 1	29.90	40.76	-4.01	0.0	272	1.461	--	--	4.65	4.65
M = 2	53.86	48.13	-4.00	0.568	212	1.544	4.31	4.04	4.74	4.74
M = 3	66.83	58.49	-3.98	0.575	131	1.897	4.19	4.09	4.65	4.65
M = 4	77.79	71.96	-4.07	0.603	96	2.357	4.26	4.22	4.57	4.57
M = 5	85.79	87.49	-4.04	0.586	83	2.732	4.22	4.18	4.51	4.51
60468/5	±0.02	±0.12	±0.03	±14%	±15%	±0.25	±0.10	±0.15	±0.30	
M = 1	29.90	30.57	-4.02	0.0	194	1.546	--	--	5.30	5.25
M = 2	53.86	35.98	-4.01	0.742	148	1.706	4.30	4.18	5.08	4.96
M = 3	66.83	43.75	-4.00	0.739	117	1.938	4.26	4.22	4.75	4.75
M = 4	77.79	54.13	-4.07	0.789	106	2.058	4.32	4.24	4.87	4.87
M = 5	85.79	65.37	-4.04	0.779	86	2.364	4.27	4.19	4.93	4.93
80968/7	±0.02	±0.12	±0.03	±11%	±10%	±0.20	±0.15	±0.30	±0.30	
M = 1	13.78	25.78	-3.95	0.0	526	1.354	--	--	4.62	4.30
M = 2	29.67	31.83	-3.94	1.37	367	1.358	5.13	4.28	4.74	4.57
M = 3	37.69	38.90	-3.95	1.41	254	1.491	4.84	4.34	4.35	4.34
M = 4	45.64	50.42	-4.00	1.48	168	1.770	4.69	4.24	4.29	4.29
M = 5	61.77	75.25	-3.94	0.0	137	2.192	--	--	3.66	3.94
M = 6	69.70	75.40	-3.93	0.0	111	2.377	--	--	3.93	3.93
M = 7	85.78	75.40	-3.97	0.0	101	2.522	--	--	3.86	3.97

SETUP DATA

VWALL/UG= -0.004

RUN:	60168-1	60468-1	80968-1
PBARO (IN. HG) =	29.86	29.81	29.89
TAMBIENT (DEG-F) =	80.0	75.2	77.0
RELATIVE HUMIDITY =	0.45	0.45	0.45
TGAS (DEG-F) =	70.24	66.93	66.68
GAS DENSITY (LBM/FT3) =	0.0745	0.0746	0.0748
GAS VISCOSITY (FT2/SEC) =	0.164E-03	0.163E-03	0.163E-03

X (INCHES)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)	UG(X) (FT/SEC)	MDOT(X) (LBM/FT2-SEC)
1.969	40.92	-0.01225	30.60	-0.00914	25.84	-0.00771
3.953	40.97		30.50		25.84	
5.973	40.92	-0.01216	30.60	-0.00915	25.80	-0.00752
7.961	40.97		30.60		25.80	
9.969	40.92	-0.01218	30.64	-0.00915	25.77	-0.00755
11.953	40.95		30.66		25.76	
13.937	40.92	-0.01221	30.60	-0.00911	25.78	-0.00762
15.945	40.97		30.66		25.84	
17.953	40.97	-0.01217	30.64	-0.00917	26.02	-0.00768
19.922	40.87		30.60		26.51	
21.938	40.84	-0.01213	30.57	-0.00915	27.15	-0.00806
23.954	40.75		30.53		28.08	
25.962	40.79	-0.01216	30.57	-0.00907	29.17	-0.00870
27.962	40.77		30.57		30.47	
29.978	40.76	-0.01217	30.57	-0.00917	31.85	-0.00938
31.939	40.77		30.57		33.28	
33.955	40.87	-0.01219	30.60	-0.00911	35.07	-0.01033
35.955	40.98		30.71		37.00	
37.971	41.28	-0.01223	30.82	-0.00927	39.08	-0.01149
39.987	41.68		31.25		41.42	
41.963	42.22	-0.01265	31.57	-0.00945	44.34	-0.01301
43.963	42.95		32.14		47.09	
45.963	43.70	-0.01300	32.76	-0.00981	50.70	-0.01505
47.979	44.64		33.43		54.94	
49.979	45.78	-0.01363	34.23	-0.01029	60.04	-0.01800
51.979	47.04		35.26		66.11	
53.995	48.33	-0.01434	36.13	-0.01076	73.04	-0.02165
55.971	49.73		37.23		75.13	
57.971	51.15	-0.01530	38.36	-0.01148	74.99	-0.02230
59.955	52.77		39.53		74.93	
61.979	54.45	-0.01629	40.70	-0.01226	74.74	-0.02211
63.971	56.09		42.05		74.71	
65.979	57.88	-0.01730	43.34	-0.01307	74.69	-0.02226
67.963	59.94		44.86		74.78	
69.971	62.13	-0.01858	46.41	-0.01399	74.78	-0.02211
71.979	64.42		48.21		74.72	
73.963	66.97	-0.02003	50.08	-0.01507	74.87	-0.02235
75.939	69.60		52.14		74.72	
77.947	72.70	-0.02175	54.39	-0.01641	74.75	-0.02218
79.939	76.07		56.91		74.71	
81.931	79.91	-0.02381	59.79	-0.01808	74.72	-0.02225
83.962	83.89		62.74		74.68	
85.931	88.27	-0.02622	65.96	-0.01970	74.66	-0.02233
87.915	93.02		69.57		74.68	
89.939	98.36	-0.02937	73.44	-0.02197	74.66	-0.02244
91.931	104.23		77.82		74.89	
93.947	110.70	-0.03226	82.71	-0.02487	75.10	-0.02244

DATE 63168 RUN NO. 1

N= 1 X= 29.90 IN. UG= 43.76 FT/SEC REDELTA2= 272.0

CF/2= 0.00465 VWALL/UG= -0.00401 K= 0.0000E 00

VWALLPLUS= -0.0588 PPLUS= 0.00000

DEL= 0.278 IN. DELTA2= 0.0137 IN. H= 1.461

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.0198	0.4375	7.75	6.41
0.0065	0.0234	0.4673	9.16	6.85
0.0075	0.0270	0.5140	10.57	7.54
0.0085	0.0306	0.5519	11.99	8.09
0.0095	0.0342	0.5942	13.40	8.72
0.0105	0.0378	0.6305	14.81	9.25
0.0115	0.0414	0.6577	16.22	9.64
0.0135	0.0486	0.7042	19.04	10.33
0.0155	0.0558	0.7470	21.86	10.95
0.0175	0.0630	0.7736	24.68	11.35
0.0195	0.0702	0.8026	27.50	11.77
0.0225	0.0810	0.8331	31.73	12.22
0.0255	0.0918	0.8523	35.96	12.50
0.0295	0.1062	0.8795	41.60	12.90
0.0345	0.1242	0.8962	48.65	13.14
0.0415	0.1494	0.9148	58.53	13.42
0.0515	0.1855	0.9302	72.62	13.64
0.0665	0.2395	0.9446	93.78	13.85
0.0865	0.3115	0.9566	121.99	14.03
0.1115	0.4015	0.9685	157.24	14.20
0.1415	0.5095	0.9741	199.55	14.28
0.1765	0.6355	0.9810	248.91	14.38
0.2215	0.7976	0.9857	312.37	14.45
0.2665	0.9597	0.9885	375.82	14.49
0.3165	1.1397	0.9953	446.34	14.59
0.3665	1.3198	0.9973	516.86	14.63
0.4165	1.4998	0.9987	587.36	14.65
0.4915	1.7699	1.0000	693.13	14.67

DATE 63168 RUN NO. 1

N= 2 X= 53.86 IN. UG= 43.13 FT/SEC REDELTA2= 211.9

CF/2= 0.00474 VWALL/UG= -0.00407 K= 0.568E-06

VWALLPLUS= -0.0591 PPLUS= -0.00174

DEL= 0.173 IN. DELTA2= 0.0087 IN. H= 1.544

Y,IN.	Y/DE	U/UG	YPLUS	UPLUS
0.0055	0.0318	0.4998	9.25	7.25
0.0065	0.0376	0.5389	10.93	7.82
0.0075	0.0434	0.5886	12.61	8.55
0.0085	0.0492	0.6458	14.29	9.38
0.0095	0.0550	0.6779	15.97	9.84
0.0105	0.0608	0.7181	17.65	10.43
0.0115	0.0666	0.7459	19.34	10.83
0.0125	0.0724	0.7707	21.02	11.19
0.0145	0.0840	0.8110	24.38	11.77
0.0165	0.0955	0.8415	27.75	12.22
0.0185	0.1071	0.8652	31.11	12.56
0.0215	0.1245	0.8971	36.15	13.03
0.0245	0.1419	0.9168	41.20	13.31
0.0285	0.1650	0.9335	47.93	13.55
0.0345	0.1998	0.9564	58.01	13.89
0.0425	0.2461	0.9636	71.47	13.99
0.0545	0.3156	0.9726	91.65	14.12
0.0675	0.3909	0.9790	113.51	14.22
0.0875	0.5067	0.9824	147.14	14.27
0.1175	0.6804	0.9849	197.59	14.30
0.1675	0.9699	0.9898	281.66	14.37
0.2175	1.2594	0.9917	365.74	14.40
0.2675	1.5489	0.9927	449.82	14.41
0.3175	1.8385	0.9937	533.91	14.43
0.3925	2.2727	0.9966	660.02	14.47
0.4675	2.7070	0.9981	786.14	14.49
0.5425	3.1413	0.9990	912.26	14.50
0.6175	3.5756	0.9995	1038.39	14.51
0.6925	4.0099	1.0000	1164.50	14.52

DATE 63168 RUN NO. 1

N= 3 X= 66.03 IN. UG= 58.49 FT/SEC REDELTA2= 130.8

CF/2= 0.00465 VWALL/UG= -0.00398 K= 0.575E-06

VWALLPLUS= -0.0583 PPLUS= -0.00181

DEL= 0.050 IN. DELTA2= 0.0044 IN. H= 1.897

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.1108	0.5516	11.12	8.09
0.0065	0.1309	0.6177	13.14	9.06
0.0075	0.1510	0.6793	15.16	9.96
0.0085	0.1712	0.7464	17.18	10.95
0.0095	0.1913	0.7782	19.20	11.41
0.0105	0.2115	0.8031	21.23	11.78
0.0115	0.2316	0.8268	23.25	12.13
0.0135	0.2719	0.8659	27.29	12.70
0.0155	0.3122	0.8964	31.33	13.15
0.0185	0.3726	0.9244	37.40	13.56
0.0215	0.4330	0.9461	43.46	13.88
0.0255	0.5134	0.9647	51.55	14.15
0.0315	0.6344	0.9778	63.68	14.34
0.0385	0.7754	0.9861	77.83	14.46
0.0465	0.9365	0.9891	94.00	14.51
0.0585	1.1782	0.9924	118.26	14.56
0.0785	1.5810	0.9941	158.69	14.58
0.1085	2.1852	0.9947	219.33	14.59
0.1485	2.9908	0.9954	300.19	14.60
0.2085	4.1992	0.9964	421.49	14.61
0.2835	5.7097	0.9990	573.09	14.65
0.3585	7.2201	0.9993	724.70	14.66
0.4335	8.7306	1.0000	876.31	14.67

DATE 63168 RUN NO. 1

N= 4 X= 77.79 IN. UG= 71.96 FT/SEC REDELTA2= 95.5

CF/2= 0.00457 VWALL/UG= -0.00407 K= 0.603E-06

VWALLPLUS= -0.0601 PPLUS= -0.00135

DEL= 0.029 IN. DELTA2= 0.0026 IN. H= 2.357

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.1878	0.6203	13.56	9.17
0.0065	0.2220	0.6790	16.02	10.04
0.0075	0.2562	0.7407	18.49	10.95
0.0085	0.2903	0.7863	20.95	11.63
0.0095	0.3245	0.8243	23.42	12.19
0.0105	0.3586	0.8499	25.88	12.57
0.0115	0.3929	0.8740	28.35	12.92
0.0125	0.4269	0.8900	30.81	13.16
0.0135	0.4611	0.9034	33.28	13.36
0.0155	0.5294	0.9286	38.21	13.73
0.0175	0.5977	0.9459	43.14	13.98
0.0195	0.6660	0.9602	48.06	14.20
0.0225	0.7685	0.9743	55.46	14.40
0.0255	0.8709	0.9827	62.85	14.53
0.0295	1.0075	0.9904	72.71	14.64
0.0335	1.1441	0.9937	82.57	14.69
0.0385	1.3149	0.9957	94.89	14.72
0.0455	1.5540	0.9975	112.14	14.74
0.0605	2.0663	0.9987	149.11	14.76
0.0805	2.7494	0.9989	198.42	14.77
0.1005	3.4324	0.9991	247.71	14.77
0.1205	4.1155	0.9996	297.00	14.78
0.1405	4.7986	0.9998	346.30	14.78
0.1605	5.4816	1.0000	395.59	14.78

DATE 67168 RUN NO. 1

N= 5 X= 85.79 IN. UG= 87.49 FT/SEC REDELTA2= 82.9

CF/2= 0.00451 VWALL/UG= -0.00434 K= 0.586E-06

VWALLPLUS= -0.0601 PPLUS= -0.00194

DEL= 0.024 IN. DELTA2= 0.0019 IN. H= 2.732

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.2326	0.6812	16.34	10.15
0.0065	0.2749	0.7554	19.31	11.25
0.0075	0.3171	0.8109	22.28	12.08
0.0085	0.3594	0.8527	25.25	12.70
0.0095	0.4017	0.8868	28.22	13.12
0.0105	0.4440	0.9001	31.19	13.41
0.0115	0.4863	0.9179	34.16	13.65
0.0125	0.5286	0.9297	37.11	13.84
0.0135	0.5709	0.9426	40.11	14.03
0.0145	0.6131	0.9504	43.08	14.15
0.0165	0.6977	0.9664	49.02	14.39
0.0185	0.7823	0.9765	54.96	14.54
0.0215	0.9091	0.9860	63.88	[illegible]
0.0245	1.0360	0.9916	72.79	[illegible]
0.0285	1.2051	0.9959	84.67	[illegible]
0.0325	1.3743	0.9975	96.56	14.85
0.0365	1.5434	0.9988	108.44	14.87
0.0415	1.7549	0.9993	123.30	14.88
0.0515	2.1777	0.9996	153.01	14.88
0.0645	2.7274	0.9997	191.64	14.89
0.0815	3.4463	0.9999	242.15	14.89
0.1015	4.2920	1.0000	301.56	14.89

DATE 63468 RUN NO. 1

N= 1 X= 25.93 IN. UG= 33.57 FT/SEC REDELTA2= 193.5

CF/2= 0.00525 VWALL/UG= -0.00422 K= [illegible] 00

VWALLPLUS= -0.0555 PPLUS= [illegible]

DEL= 0.242 IN. DELTA2= [illegible] IN. H= 1.566

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.0227	0.3882	6.23	5.36
0.0065	0.0269	0.4377	7.36	6.04
0.0075	0.0310	0.4792	8.49	6.62
0.0085	0.0351	0.5093	9.63	7.01
0.0095	0.0392	0.5468	10.76	7.54
0.0105	0.0434	0.5908	11.89	[illegible]
0.0115	0.0475	0.6129	13.02	8.45
0.0125	0.0516	0.6302	14.15	8.69
0.0145	0.0599	0.6795	16.42	9.39
0.0165	0.0682	0.7189	18.68	9.91
0.0185	0.0764	0.7498	20.94	10.35
0.0205	0.0847	0.7703	23.21	10.63
0.0235	0.0971	0.8037	[illegible]	11.08
0.0265	0.1095	0.8301	30.00	11.46
0.0305	0.1260	0.8556	34.54	[illegible]
0.0345	0.1425	0.8790	39.06	12.13
0.0395	0.1632	0.9032	44.72	12.47
0.0445	0.1839	0.9216	50.38	12.72
0.0505	0.2086	0.9306	57.17	12.84
0.0585	0.2417	0.9484	66.23	13.09
0.0685	[illegible]	0.9547	77.56	13.17
0.0835	0.3450	0.9597	94.54	13.24
0.1085	0.4483	0.9733	122.84	13.43
0.1435	0.5929	0.9819	162.47	13.54
0.1835	0.7581	0.9843	207.76	13.58
0.2335	0.9647	0.9892	264.36	13.65
0.2835	1.1713	0.9947	[illegible]	13.72
0.3335	1.3779	0.9976	377.59	13.77
0.3835	1.5844	0.9988	434.19	13.78
0.4335	1.7913	1.0000	[illegible]	[illegible]

DATE 63468 RUN NO. 1

N= 2 X= 53.86 IN. UG= 35.98 FT/SEC REDELTA2= 148.4

CF/2= 0.00496 VWALL/UG= -0.00401 K= 0.742E-06

VWALLPLUS= -0.0565 PPLUS= -0.00213

DEL= 0.122 IN. DELTA2= 0.0091 IN. H= 1.706

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.0451	0.4281	7.12	6.08
0.0065	0.0533	0.4667	8.42	6.63
0.0075	0.0615	0.4989	9.71	7.09
0.0085	0.0697	0.5515	11.01	7.84
0.0095	0.0779	0.5952	12.30	8.45
0.0105	0.0861	0.6345	13.60	9.01
0.0115	0.0943	0.6638	14.89	9.42
0.0125	0.1025	0.6905	16.19	9.81
0.0135	0.1107	0.7151	17.49	10.16
0.0145	0.1189	0.7365	18.77	10.45
0.0155	0.1271	0.7607	20.07	10.80
0.0175	0.1435	0.7919	22.66	11.24
0.0195	0.1599	0.8208	25.25	11.65
0.0215	0.1763	0.8456	27.84	12.01
0.0235	0.1927	0.8638	30.42	12.26
0.0265	0.2173	0.8865	34.31	12.59
0.0305	0.2501	0.9124	39.49	12.96
0.0355	0.2911	0.9330	45.97	13.25
0.0415	0.3403	0.9495	53.73	13.48
0.0495	0.4059	0.9640	64.09	13.69
0.0625	0.5125	0.9764	[illegible]	13.86
0.0805	[illegible]	0.9835	104.23	13.96
0.1075	0.8814	0.9878	139.19	14.02
0.1425	1.1684	0.9931	[illegible]	14.11
0.1825	1.4964	0.9948	236.29	14.13
0.2325	1.9064	0.9957	301.03	14.14
0.2825	2.3163	0.9974	365.77	14.17
0.3325	2.7263	0.9983	430.50	14.18
0.3825	3.1363	1.0000	495.24	14.20

DATE 63468 RUN NO. 1

N= 3 X= 66.83 IN. UG= 43.75 FT/SEC REDELTA2= 117.0

CF/2= 0.00475 VWALL/UG= -0.00400 K= 0.739E-06

VWALLPLUS= -0.0581 PPLUS= -0.00226

DEL= 0.059 IN. DELTA2= 0.0052 IN. H= 1.938

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.0934	0.4634	8.48	6.72
0.0065	0.1104	0.5045	10.02	7.31
0.0075	0.1274	0.5520	11.56	8.01
0.0085	0.1444	0.6189	13.09	8.98
0.0095	0.1614	0.6609	14.63	9.59
0.0105	0.1784	0.6954	[illegible]	[illegible]
0.0115	0.1954	0.7266	17.72	10.54
0.0125	0.2124	0.7550	19.26	10.95
0.0135	0.2294	0.7801	20.80	11.31
0.0145	0.2464	0.7996	22.34	11.59
0.0155	0.2633	0.8231	23.87	11.94
0.0175	0.2973	0.8510	26.96	[illegible]
0.0195	0.3313	0.8754	30.04	12.69
0.0215	0.3653	0.8971	33.13	13.01
0.0235	0.3993	0.9126	[illegible]	13.24
0.0255	0.4332	0.9272	39.29	13.45
0.0285	0.4842	0.9441	43.91	13.69
0.0315	0.5352	0.9564	48.53	13.87
0.0365	0.6201	0.9691	56.24	14.05
0.0445	0.7561	0.9823	68.56	14.24
0.0565	0.9599	0.9894	87.04	14.35
0.0735	1.2488	0.9936	113.24	14.42
0.0965	1.6395	0.9953	148.67	14.44
0.1365	2.3191	0.9971	210.30	14.47
0.1865	3.1686	0.9982	287.32	14.48
0.2365	4.0181	1.0000	[illegible]	14.51

DATE 61468 RUN NO. 1

N= 4 X= 77.79 IN. UG= 54.13 FT/SEC REDELTA2= 106.1

CF/2= 0.00487 VWALL/UG= -0.00437 K= 0.789E-06

VWALLPLUS= -0.0587 PPLUS= -0.00233

DEL= 0.044 IN. DELTA2= 0.0038 IN. H= 2.058

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.1253	0.5562	10.61	7.88
0.0065	0.1481	0.6038	12.54	8.65
0.0075	0.1709	0.6617	14.47	9.48
0.0085	0.1936	0.7135	16.39	10.23
0.0095	0.2164	0.7484	18.32	10.72
0.0105	0.2392	0.7809	20.25	11.19
0.0115	0.2620	0.8078	22.18	11.58
0.0125	0.2848	0.8283	24.11	11.87
0.0135	0.3075	0.8457	26.03	12.17
0.0145	0.3303	0.8618	27.96	12.35
0.0165	0.3759	0.8888	31.82	12.73
0.0185	0.4214	0.9117	35.68	13.07
0.0205	0.4670	0.9291	39.53	13.32
0.0235	0.5353	0.9487	45.32	13.59
0.0265	0.6037	0.9622	51.11	13.79
0.0305	0.6948	0.9753	58.81	13.97
0.0365	0.8315	0.9850	70.39	14.11
0.0445	1.0137	0.9904	85.81	14.19
0.0545	1.2415	0.9939	105.09	14.24
0.0665	1.5149	0.9946	124.22	14.25
0.0865	1.9705	0.9969	166.90	14.28
0.1115	2.5400	0.9985	215.09	14.30
0.1415	3.2234	0.9985	272.94	14.31
0.1715	3.9069	1.0000	330.70	14.33

DATE 61468 RUN NO. 1

N= 5 X= 85.79 IN. UG= 65.37 FT/SEC REDELTA2= 86.2

CF/2= 0.00493 VWALL/UG= -0.00404 K= 0.779E-06

VWALLPLUS= -0.0576 PPLUS= -0.00225

DEL= 0.030 IN. DELTA2= 0.0026 IN. H= 2.364

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0055	0.1814	0.6337	12.88	9.03
0.0065	0.2144	0.6899	15.23	9.82
0.0075	0.2473	0.7486	17.57	10.65
0.0085	0.2803	0.7865	19.91	11.20
0.0095	0.3133	0.8194	22.25	11.67
0.0105	0.3463	0.8455	24.59	12.04
0.0115	0.3793	0.8654	26.93	12.32
0.0125	0.4122	0.8834	29.28	12.58
0.0135	0.4452	0.8955	31.62	12.75
0.0155	0.5112	0.9226	36.30	13.13
0.0175	0.5771	0.9411	40.99	13.39
0.0195	0.6431	0.9565	45.68	13.61
0.0215	0.7091	0.9667	50.36	13.77
0.0245	0.8080	0.9783	57.39	13.93
0.0275	0.9069	0.9850	64.41	14.03
0.0315	1.0389	0.9921	73.76	14.13
0.0355	1.1708	0.9945	83.14	14.16
0.0415	1.3687	0.9976	97.20	14.21
0.0485	1.5995	0.9990	113.59	14.22
0.0565	1.8634	0.9995	132.33	14.23
0.0715	2.3580	1.0000	167.46	14.24

DATE 81969 RUN NO. 1

N= 1 X= 13.78 IN. UG= 25.78 FT/SEC REDELTA2= 525.5

CF/2= 0.00433 VWALL/UG= -0.00395 K= 0.000E 00

VWALLPLUS= -0.0603 PPLUS= 0.00000

DEL= 0.465 IN. DELTA2= 0.0399 IN. H= 1.354

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0129	0.3234	5.19	4.93
0.0070	0.0151	0.3466	6.05	5.28
0.0080	0.0172	0.3656	6.93	5.58
0.0090	0.0194	0.3853	7.79	5.88
0.0100	0.0215	0.4308	8.66	6.57
0.0110	0.0237	0.4559	9.52	6.95
0.0120	0.0258	0.4846	10.39	7.40
0.0140	0.0301	0.5279	12.12	8.05
0.0160	0.0344	0.5821	13.85	8.88
0.0180	0.0387	0.6157	15.58	9.40
0.0200	0.0430	0.6398	17.31	9.75
0.0220	0.0473	0.6655	19.05	10.15
0.0240	0.0517	0.6829	20.78	10.42
0.0270	0.0581	0.7047	23.37	10.75
0.0310	0.0667	0.7327	26.83	11.17
0.0360	0.0775	0.7486	31.17	11.42
0.0440	0.0947	0.7772	38.09	11.86
0.0540	0.1162	0.7985	46.74	12.18
0.0690	0.1485	0.8192	59.73	12.59
0.0890	0.1915	0.8374	77.03	12.77
0.1140	0.2453	0.8572	98.68	13.09
0.1390	0.2991	0.8670	120.32	13.23
0.1740	0.3745	0.8918	150.61	13.60
0.2090	0.4498	0.9030	180.91	13.77
0.2490	0.5359	0.9268	215.52	14.14
0.2890	0.6220	0.9354	250.15	14.33
0.3390	0.7296	0.9652	293.43	14.72
0.3890	0.8372	0.9735	336.71	14.85
0.4390	0.9449	0.9848	379.99	15.02
0.4890	1.0524	0.9950	423.27	15.17
0.5390	1.1600	0.9983	466.55	15.22
0.5890	1.2676	1.0000	509.82	15.26

DATE 81969 RUN NO. 1

N= 2 X= 29.67 IN. UG= 31.83 FT/SEC REDELTA2= 367.0

CF/2= 0.00457 VWALL/UG= -0.00394 K= 0.137E-05

VWALLPLUS= -0.0584 PPLUS= -0.00442

DEL= 0.412 IN. DELTA2= 0.0225 IN. H= 1.358

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0146	0.3932	6.61	5.82
0.0070	0.0170	0.4124	7.71	6.10
0.0080	0.0194	0.4530	8.81	6.70
0.0090	0.0219	0.5014	9.92	7.42
0.0100	0.0243	0.5415	11.02	8.01
0.0110	0.0267	0.5750	12.11	8.51
0.0120	0.0292	0.5920	13.21	8.76
0.0140	0.0340	0.6505	15.42	9.63
0.0160	0.0389	0.6899	17.63	10.21
0.0180	0.0437	0.7220	19.82	10.69
0.0200	0.0486	0.7510	22.03	11.11
0.0220	0.0535	0.7741	24.23	11.45
0.0240	0.0583	0.7952	26.44	11.77
0.0270	0.0656	0.8224	29.74	12.17
0.0300	0.0729	0.8370	33.05	12.39
0.0340	0.0826	0.8591	37.45	12.71
0.0390	0.0948	0.8730	42.96	12.92
0.0470	0.1142	0.8881	51.76	13.14
0.0590	0.1434	0.9077	64.99	13.43
0.0730	0.1774	0.9166	80.41	13.56
0.0930	0.2260	0.9292	102.44	13.75
0.1180	0.2867	0.9363	129.97	13.85
0.1430	0.3475	0.9422	157.51	13.95
0.1930	0.4689	0.9550	212.58	14.13
0.2430	0.5904	0.9618	267.66	14.24
0.2930	0.7119	0.9755	322.73	14.43
0.3430	0.8334	0.9800	377.80	14.51
0.3930	0.9549	0.9867	432.88	14.60
0.4430	1.0764	0.9956	487.95	14.73
0.4930	1.1979	0.9989	543.03	14.79
0.5430	1.3194	1.0000	598.10	14.80

DATE 81968 RUN NO. 1

N= 3 X= 37.69 IN. UG= 34.9[illegible] FT/SEC REDELTA2= 25[illegible].5

CF/2= 0.00434 VWALL/UG= -0.00135 K= 0.141E-05

VWALLPLUS= -0.0[illegible] PPLUS= -0.00493

DEL= 0.275 IN. DELTA2= 0.0127 IN. H= 1.491

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0219	0.4137	7.97	6.28
0.0070	0.0255	0.4463	9.17	6.78
0.0080	0.0291	0.5037	10.49	7.65
0.0090	0.0328	0.5513	11.80	8.37
0.0100	0.0364	0.6073	13.11	9.22
0.0110	0.0401	0.6358	14.42	9.66
0.0120	0.0437	0.6751	15.73	10.26
0.0130	0.0473	0.7039	17.04	10.64
0.0150	0.0546	0.7427	19.66	11.28
0.0170	0.0619	0.7918	22.28	12.03
0.0190	0.0692	0.8147	24.91	12.37
0.0210	0.0765	0.8344	27.53	12.67
0.0240	0.0874	0.8648	31.47	13.13
0.0270	0.0983	0.8842	35.40	13.43
0.0310	0.1129	0.9023	40.64	13.71
0.0370	0.1348	0.9201	48.51	13.98
0.0470	0.1712	0.9399	61.62	14.27
0.0570	0.2076	0.9501	74.73	14.43
0.0720	0.2622	0.9661	94.40	14.59
0.0920	0.3351	0.9647	120.62	14.66
0.1320	0.4808	[illegible]716	173.07	14.76
0.1820	0.6629	[illegible]9791	239.63	14.87
0.2320	0.8452	[illegible]835	304.19	14.94
0.2820	1.02[illegible]	[illegible]1	369.73	15.05
0.3320	1.2[illegible]2	0.9954	435.29	15.10
0.3820	1.3913	0.9963	500.84	15.13
0.4320	1.5735	0.9975	566.40	15.15
0.4820	1.7556	0.9985	631.76	15.16
0.5320	1.9377	1.0000	697.51	15.19

DATE 81968 RUN NO. 1

N= 4 X= 45.64 IN. UG= 53.42 FT/SEC REDELTA2= 168.3

CF/2= 0.00429 VWALL/UG= -0.00400 K= 0.148E-05

VWALLPLUS= -0.0610 PPLUS= -0.00528

DEL= 0.142 IN. DELTA2= 0.0065 IN. H= 1.770

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.0424	0.4875	10.14	7.44
0.0070	0.0494	0.5248	11.83	8.02
0.0080	0.0565	0.5573	13.52	8.51
0.0090	0.0636	0.6319	15.21	9.65
0.0100	0.0706	0.6745	16.89	10.30
0.0110	0.0777	0.7153	18.58	10.93
0.0120	0.0848	0.7559	20.28	11.54
0.0130	0.0918	0.7805	21.97	11.91
0.0140	0.0989	0.8054	23.66	12.30
0.0150	0.1060	0.8237	25.34	12.58
0.0170	0.1201	0.8556	28.72	13.06
0.0190	0.1342	0.8849	32.10	13.51
0.0210	0.1483	0.9036	35.48	13.80
0.0240	0.1695	0.9247	40.55	14.12
0.0270	0.1907	0.9412	45.62	14.37
0.0300	0.2119	0.9509	50.69	14.52
0.0340	0.2402	0.9619	57.44	14.69
0.0400	0.2825	0.9706	67.58	14.82
0.0470	0.3320	0.9760	79.41	14.90
0.0570	0.4026	0.9805	96.30	14.97
0.0720	0.5086	0.9837	121.64	15.01
0.0920	0.6498	0.9876	155.44	15.07
0.1220	0.8618	0.9894	206.12	15.10
0.1570	1.1090	0.9905	265.25	15.12
0.2070	1.4622	0.9956	349.73	15.21
0.2570	1.8153	0.9974	434.20	15.23
0.3070	2.1685	0.9991	518.69	15.26
0.3570	2.5217	0.9996	603.16	15.27
0.4070	2.8749	1.0000	687.64	15.27

DATE 81969 RUN NO. 1

N= 5 X= 61.77 IN. UG= 75.25 FT/SEC REDELTA2= 136.6

CF/2= 0.00394 VWALL/UG= -0.00394 K= 0.000E 00

VWALLPLUS= -0.0628 PPLUS= 0.00000

DEL= 0.035 IN. DELTA2= 0.0036 IN. H= 2.192

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.1698	0.5520	14.47	8.79
0.0070	0.1981	0.6101	16.89	9.72
0.0080	0.2264	0.6718	19.30	10.70
0.0090	0.2549	0.7339	21.71	11.69
0.0100	0.2831	0.7758	24.13	12.36
0.0110	0.3114	0.8077	26.54	12.87
0.0120	0.3397	0.8360	28.95	13.32
0.0130	0.3680	0.8561	31.37	13.64
0.0140	0.3963	0.8717	33.78	13.89
0.0150	0.4246	0.8883	36.19	14.15
0.0160	0.4529	0.9037	38.60	14.40
0.0170	0.4812	0.9165	41.01	14.60
0.0180	0.5095	0.9264	43.43	14.75
0.0200	0.5661	0.9443	48.25	15.04
0.0220	0.6227	0.9576	53.08	15.25
0.0240	0.6793	0.9675	57.91	15.41
0.0270	0.7643	0.9780	65.14	15.58
0.0310	0.8775	0.9857	74.79	15.70
0.0370	1.0473	0.9917	89.27	15.79
0.0490	1.3870	0.9952	118.22	15.85
0.0690	1.9531	0.9964	166.47	15.87
0.0940	2.6607	0.9968	226.78	15.88
0.1440	4.0760	0.9978	347.42	15.90
0.2190	6.1989	0.9992	528.36	15.92
0.2940	8.3219	0.9998	709.32	15.93
0.3690	9.9999	1.0000	890.26	15.93

DATE 81969 RUN NO. 1

N= 6 X= 69.70 IN. UG= 75.40 FT/SEC REDELTA2= 111.1

CF/2= 0.00393 VWALL/UG= -0.00393 K= 0.000E 00

VWALLPLUS= -0.0627 PPLUS= 0.00000

DEL= 0.032 IN. DELTA2= 0.0029 IN. H= 2.377

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.1847	0.5876	14.48	9.37
0.0070	0.2155	0.6644	16.89	10.60
0.0080	0.2463	0.7282	19.31	11.62
0.0090	0.2771	0.7738	21.72	12.34
0.0100	0.3078	0.8159	24.13	13.02
0.0110	0.3386	0.8420	26.54	13.44
0.0120	0.3694	0.8632	28.96	13.77
0.0130	0.4002	0.8821	31.37	14.08
0.0140	0.4310	0.8976	33.78	14.33
0.0150	0.4618	0.9115	36.20	14.55
0.0160	0.4925	0.9205	38.61	14.69
0.0180	0.5541	0.9404	43.43	15.00
0.0200	0.6157	0.9555	48.26	15.25
0.0220	0.6772	0.9666	53.09	15.42
0.0250	0.7696	0.9785	60.33	15.62
0.0300	0.9235	0.9881	72.39	15.77
0.0400	1.2314	0.9957	96.53	15.89
0.0650	2.0009	0.9980	156.85	15.93
0.0900	2.7705	0.9990	217.18	15.95
0.1150	3.5401	0.9992	277.51	15.95
0.1400	4.3097	0.9994	337.84	15.95
0.1650	5.0793	0.9996	398.16	15.96
0.1900	5.8489	0.9998	458.49	15.96
0.2400	7.3881	1.0000	579.15	15.96

DATE 83568 RUN NO. 1

N= 7 X= 85.78 IN. UG= 75.40 FT/SEC REDELTA2= 101.3

CF/2= 0.00397 VWALL/UG= -0.00397 K= 0.000E 00

VWALLPLUS= -1.0631 PPLUS= 0.00000

DEL= 0.029 IN. DELTA2= 0.0026 IN. H= 2.522

Y,IN.	Y/DEL	U/UG	YPLUS	UPLUS
0.0060	0.2063	0.5834	14.55	9.26
0.0070	0.2406	0.6396	16.98	10.16
0.0080	0.2750	0.7096	19.41	11.27
0.0090	0.3094	0.7811	21.83	12.40
0.0100	0.3438	0.8134	24.26	12.92
0.0110	0.3781	0.8401	26.68	13.34
0.0120	0.4125	0.8586	29.11	13.63
0.0130	0.[illegible]9	0.8830	31.54	14.02
0.0140	0.4813	0.9007	33.96	14.30
0.0150	0.5156	0.9128	36.39	14.49
0.0170	0.5844	0.9352	41.24	14.85
0.0190	0.6531	0.9529	46.09	15.13
0.0220	0.7563	0.9717	53.36	15.42
0.0250	0.8594	0.9823	60.65	15.60
0.0300	1.0313	0.9917	72.78	15.75
0.0360	1.2375	0.9972	87.33	15.84
0.0420	1.4438	0.9992	101.88	15.87
0.0480	1.6501	1.0000	116.44	15.88

APPENDIX B

BASIC DATA REDUCTION PROGRAM LISTING

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$WATFOR
C
C     THE FOLLOWING PROGRAM REDUCES CONSTANT VELOCITY PROFILE DATA TAKEN
C     ON THE STANFORD HEAT AND MASS TRANSFER APPARATUS
C
C
C  SOME OF THE SYMBOLS UTILIZED IN THE PROGRAM REPRESENT THE FOLLOWING
C  IMPORTANT QUANTITIES:
C
C     CFFLAG= 1.0 IF PROFILE IS IN PRESSURE GRADIENT REGION
C             0.0 IF NOT IN PRESSURE GRADIENT REGION
C     CMFLAG= 1.0 IF LARGE ROTAMETERS USED IN FORWARD SECTION
C             0.0 IF SMALL ROTAMETERS USED IN FORWARD SECTION
C     NPLATE= PLATE AT WHICH DIFFERENT ROTAMETER IS FIRST USED
C             0 IF ONLY ONE TYPE OF ROTAMETER USED
C
C     CM= ROTAMETER SETTINGS
C     EO= PLATE TEMPERATURE (MILLIVOLTS)
C     OD= HEIGHT OF PROBE HEAD (INCHES)
C     P= TOTAL PRESSURE MINUS REFERENCE STATIC PRESSURE (IN. H2O)
C        NOTE: REFERENCE STATIC PORT ADJACENT TO PROBE TIP
C     PBAR= BAROMETRIC PRESSURE (IN. HG)
C     PO= REFERENCE STATIC PRESSURE (IN. H2O)
C     PROT= PRESSURE OF ROTAMETERS ABOVE AMBIENT PRESSURE (MM HG)
C     PTOTAL= TOTAL PRESSURE IN DUCT (IN. H2O)
C     RHUM= RELATIVE HUMIDITY
C     TAMB= AMBIENT TEMPERATURE (DEG-F)
C     TG= FREESTREAM GAS TEMPERATURE (MILLIVOLTS OR DEG-F)
C     TROT= TEMPERATURE OF GAS ENTERING ROTAMETERS (MILLIVOLTS)
C     X= DISTANCE OF PROBE TIP FROM ENTRANCE OF TEST SECTION (INCHES)
C
C     Y= DISTANCE FROM PLATE SURFACE (INCHES)
C     U= MEAN VELOCITY (FT/SEC)
C     UGG= LOCAL FREESTREAM VELOCITY (FT/SEC)
C     UUG= U/UGG
C     YDEL= Y/DEL
C
C     DEL= Y-POSITION WHERE UUG=0.99 (INCHES)
C     DELT1= DISPLACEMENT THICKNESS (INCHES)
C     DELT2= MOMENTUM THICKNESS (INCHES)
C     H= SHAPE FACTOR
C     REDEL2= MOMENTUM THICKNESS REYNOLDS NUMBER
C
C     FM= LOCAL BLOWING FRACTION VO/UGG
C     MDOTM= LOCAL MASS FLUX AT PLATE SURFACE (LBM/SEC-FT2)
C     KM= LOCAL PRESSURE GRADIENT PARAMETER
C
C     CF2SL= CF/2 BASED ON SUBLAYER EQUATION AND FIRST DATA POINT
C     CF2SL2= CF/2 BASED ON SUBLAYER EQUATION AND SECOND DATA POINT
C     UPLUS1= U+ BASED ON CF2SL
C     YPLUS1= Y+ BASED ON CF2SL
C     PPLUS1= P+ BASED ON CF2SL
C     VPLUS1= VO+ BASED ON CF2SL
C
C     CFMICR= CF/2 BASED ON COMPLETE TRANSFORMED MOMENTUM INTEGRAL EQU.
C     CF2MI= CF/2 BASED ON ASYMPTOTIC FORM OF MOMENTUM INTEGRAL EQUATION
C     UPLUS2= U+ BASED ON CFMICR
C     YPLUS2= U+ BASED ON CFMICR
C     PPLUS2= P+ BASED ON CFMICR
C     VPLUS2= VO+ BASED ON CFMICR
C
C I. DECLARATION OF VARIABLE TYPES
C
      REAL A,B,C,CFCORR(10),CFFLAG(10),CFMICR(10),CF2MI(10),CF2SL(10),
     1CF2SL2(10),CH2O,CM(24),CMFLG,CP1,CP2,D,DCP,DDP(10),DEE1(10),
     2DEE2(10),DEL(10),DEL1(10),DEL2(10),DELT1(10),DELT2(10),DUDX(48),
     3EO(24),EPS,F(24),FM(10),H(10),K(48),KFLOW(24),KFUDGE(24),KM(10),
     4MA,MDOT(24),MDOTM(10),MV,OD(10),P(10,50),PAMB,PBAR,PINF(10),PO(48)
     5,PPLUS1(10),PPLUS2(10),PROT,PROTA,PROTAB,PTOTAL,PSAT(12),PVAP,RA,
     6RAD,REDEL2(10),REP,REP1,REPS,REX(48),REXUGG(10),RHOA,RHOG(48),RHOH
     7,RHOL,RHOSAT(12),RHOU,RHOV,RHOZRO(24),RHUM,RM,SFLAG(10),
     8SUM1(10,50),SUM2(10,50),T,TAMB,TAVG(24),TEMP(12),TG,TO(24),TROT,
     9TROTA,U(10,50),UG(48),UGG(10),UPLUS1(10,50),UPLUS2(10,50),
     1UUG(10,50),VAPH,VAPL,VEPS,VISC(10),VISCG(48),VPLUS1(10),VPLUS2(10)
     2,VZERO(24),VZEROM(10),WACT(24),WSTD(24),WSTDJ,X(10),XS(48),
     3Y(10,50),YDEL(10,50),YO(10),YPLUS1(10,50),YPLUS2(10,50)
      INTEGER DATE,DP,NPREF(10),R,RUNNO,S,Z(10)
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C
C II. FIXED DATA INPUTS
C
C    A: KFLOW,KFUDGE= CORRECTION TERMS THAT WEIGHT ROTAMETER READINGS FOR
C                     FLOW THROUGH CENTER 6-IN. SPAN OF PLATE
C
       DATA KFLOW(1),KFLOW(2),KFLOW(3),KFLOW(4),KFLOW(5),KFLOW(6),KFLOW(7
      1),KFLOW(8),KFLOW(9),KFLOW(10),KFLOW(11),KFLOW(12),KFLOW(13),
      2KFLOW(14),KFLOW(15),KFLOW(16),KFLOW(17),KFLOW(18),KFLOW(19),
      3KFLOW(20),KFLOW(21),KFLOW(22),KFLOW(23),KFLOW(24)/1.0204,1.0101,
      41.0309,1.0417,1.0309,1.0309,1.0183,1.0493,1.0225,1.0449,1.0331,
      51.0428,1.0504,1.0373,1.0526,1.0152,1.0341,1.0331,1.0081,1.0471,
      61.0363,1.0428,1.0018,1.0331/
       DATA KFUDGE(1),KFUDGE(2),KFUDGE(3),KFUDGE(4),KFUDGE(5),KFUDGE(6),
      1KFUDGE(7),KFUDGE(8),KFUDGE(9),KFUDGE(10),KFUDGE(11),KFUDGE(12),
      2KFUDGE(13),KFUDGE(14),KFUDGE(15),KFUDGE(16),KFUDGE(17),KFUDGE(18),
      3KFUDGE(19),KFUDGE(20),KFUDGE(21),KFUDGE(22),KFUDGE(23),KFUDGE(24)/
      4-0.010,0.024,0.0,-0.0025,0.0080,0.004,0.004,-0.008,0.008,0.0,0.008
      5,0.008,0.0,0.012,0.006,0.016,0.010,0.016,0.016,0.005,0.016,0.010,
      60.010,0.008/
C
C    B: XS= POSITIONS OF STATIC PORTS
C
       DATA XS(1),XS(2),XS(3),XS(4),XS(5),XS(6),XS(7),XS(8),XS(9),XS(10),
      1XS(11),XS(12),XS(13),XS(14),XS(15),XS(16),XS(17),XS(18),XS(19),
      2XS(20),XS(21),XS(22),XS(23),XS(24),XS(25),XS(26),XS(27),XS(28),
      3XS(29),XS(30),XS(31),XS(32),XS(33),XS(34),XS(35),XS(36),XS(37),
      4XS(38),XS(39),XS(40),XS(41),XS(42),XS(43),XS(44),XS(45),XS(46),
      5XS(47),XS(48)/1.969,3.953,5.953,7.961,9.969,11.953,13.937,15.945,
      617.953,19.922,21.938,23.954,25.962,27.962,29.978,31.939,33.955,
      735.955,37.971,39.987,41.963,43.963,45.963,47.979,49.979,51.979,
      853.995,55.971,57.971,59.955,61.979,63.971,65.979,67.963,69.971,
      971.979,73.963,75.939,77.947,79.939,81.931,83.962,85.931,87.915,
      289.939,91.931,93.947,96.0/
C
C    C: PROPERTIES OF DRY AIR
C
       DATA TEMP(1),TEMP(2),TEMP(3),TEMP(4);TEMP(5),TEMP(6),TEMP(7),
      1TEMP(8),TEMP(9)/40.0,50.0,60.0,70.0,80.0,90.0,100.0,110.0,120.0/
       DATA PSAT(1),PSAT(2),PSAT(3),PSAT(4),PSAT(5),PSAT(6),PSAT(7),
      1PSAT(8),PSAT(9)/17.53,25.65,36.90,52.20,73.00,100.40,136.50,183.60
      2,243.70/
       DATA RHOSAT(1),RHOSAT(2),RHOSAT(3),RHOSAT(4),RHOSAT(5),RHOSAT(6),
      1RHOSAT(7),RHOSAT(8),RHOSAT(9)/0.000409,0.000587,0.000830,0.001153,
      20.001580,0.002139,0.002853,0.003770,0.004920/
C
C    D: THERMOCOUPLE CALIBRATION CONSTANTS
C
       DATA A,B,C,D/-2220.703,781.25,7.950782,0.256/
C
C III. READING AND RECORDING OF INPUT DATA
C
C    A: RUN CLASSIFICATION
C
     1 FORMAT(I6,2X,I1,2X,I1,2X,F5.0,6X,I2)
     2 READ(5,1) DATE,RUNNO,S,RAD,NPLATE
     3 FORMAT(1H1)
       WRITE(6,3)
       WRITE(6,3)
       WRITE(6,3)
     4 FORMAT(37H        RUN NO.   NO. OF TRAV.   RADIUS)
       WRITE(6,4)
     5 FORMAT(5X,I6,1H-,I1,8X,I1,10X,F5.3)
       WRITE(6,5) DATE,RUNNO,S,RAD
```

```
C
C    B: INDIVIDUAL PROFILE DATA
C
       DO 13 M=1,S
     6 FORMAT(F6.0,2X,F6.0,2X,I2,2X,I2,2X,F5.0,2X,F4.1)
       READ(5,6) X(M),PINF(M),NPREF(M),Z(M),OD(M),CFFLAG(M)
     7 FORMAT(///,44H         X        PINF    REF    Z    OD      CFFLAG)
       WRITE(6,7)
     8 FORMAT(5X,F6.3,2X,F6.4,2X,I2,3X,I2,2X,F5.3,4X,F4.1,//)
       WRITE(6,8) X(M),PINF(M),NPREF(M),Z(M),OD(M),CFFLAG(M)
    10 FORMAT(5X,21H  R      Y      PT-POREF,/)
       WRITE(6,10)
       DP=Z(M)
       DO 12 R=1,DP
     9 FORMAT(2F10.0)
       READ(5,9) Y(M,R),P(M,R)
    11 FORMAT(6X,I2,3X,F5.3,3X,F6.4)
    12 WRITE(6,11) R,Y(M,R),P(M,R)
    13 CONTINUE
       WRITE(6,3)
C
C    C: STATIC PRESSURE DISTRIBUTION DATA
C
    14 FORMAT(5X,32H I       PO(I)          I       PO(I))
       WRITE(6,14)
       DO 17 J=1,24
       L=J+24
    15 FORMAT(5X,F8.0,24X,F7.0)
       READ(5,15) PO(J),PO(L)
    16 FORMAT(5X,I2,3X,F7.4,8X,I2,3X,F7.4)
       WRITE(6,16) J,PO(J),L,PO(L)
    17 CONTINUE
C
C    D: SETUP DATA
C
    18 FORMAT(7F8.0,F4.0)
       READ(5,18) TAMB,TG,TROT,PBAR,RHUM,PROT,PTOTAL,CMFLG
    19 FORMAT(//,5X,55HTAMB    TG       TROT      PBAR     RHUM  PROT   PTOTAL
      1CMFLG)
       WRITE(6,19)
    20 FORMAT(5X,F5.2,F7.3,2X,F5.2,2X,F5.2,4X,F4.2,1X,F5.1,1X,F7.4,2X,F4.
      11)
       WRITE(6,20) TAMB,TG,TROT,PBAR,RHUM,PROT,PTOTAL,CMFLG
    21 FORMAT(//,5X,19H I     EO(I)    CM(I))
       WRITE(6,21)
       DO 24 I=1,24
    22 FORMAT(3X,2F10.0)
       READ(5,22) EO(I),CM(I)
    23 FORMAT(5X,I2,4X,F5.3,3X,F5.2)
       WRITE(6,23) I,EO(I),CM(I)
    24 CONTINUE
C
C IV. CALCULATION OF FLUID PROPERTIES AND ASSOCIATED CONSTANTS
C
C    A: CONVERSION OF THERMOCOUPLE DATA
C
       IF(TG.LT.10.0) TG=A+B*SQRT(C+D*TG)+49.93
       IF(TROT.LT.10.0) TROT=A+B*SQRT(C+D*TROT)+49.93
       TROTA=TROT+460.0
C
C    B: CH2O CORRECTS DENSITY OF H2O FROM 62.4266 FOR AMBIENT TEMPERATURE
C
       CH2O=0.99732-0.0001395*(TAMB-75.0)
C
C    C: PRESSURE CONVERSIONS
C
       PAMB=PBAR*2116.0/29.96
       PROTA=PBAR+PROT/25.4
       PROTAB=2116.0*PROTA/29.96
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C
C   D: MIXTURE COMPOSITION IS DETERMINED FROM RELATIVE HUMIDITY AND USED
C      TO GET MIXTURE GAS CONSTANT RM VIA PERFECT GAS ASSUMPTION
C
      DO 25 N=1,9
      IF(TEMP(N).GE.TAMB) GO TO 26
   25 CONTINUE
   26 T=TEMP(N)
      EPS=T-TAMB
      VAPH=PSAT(N)
      VAPL=PSAT(N-1)
      VEPS=VAPH-VAPL
      RHOH=RHOSAT(N)
      RHOL=RHOSAT(N-1)
      REPS=RHOH-RHOL
      RHOV=RHOL+(10.0-EPS)*REPS/10.0
      RA=53.3
      PVAP=RHUM*(VAPL+10.0-EPS)*VEPS/10.0
      RHOA=((PAMB-PVAP)/(RA*(TAMB+460.0))+(RHUM*RHOV))
      MV=RHUM*RHOV/RHOA
      MA=1.0-MV
      RM=1545.0*(MA/28.9+MV/18.0)
C
C V. PROCESSING OF FREESTREAM DATA
C
      DO 27 I=1,48
      RHOG(I)=(PAMB+5.20*PO(I))/(RM*(TG+460.0))
      VISCG(I)=(11.0+0.0175*TG)/(1000000.0*RHOG(I))
   27 UG(I)=SQRT((64.34*(PTOTAL-PO(I))*(62.4*CH2O/RHOG(I))/12.0))
      DUDX(1)=(UG(2)-UG(1))/(XS(1)/12.0)
      K(1)=VISCG(1)*DUDX(1)/(UG(1)*UG(1))
      REX(1)=UG(1)*XS(1)/(12.0*VISCG(1))
      DO 28 I=2,47
      DUDX(I)=12.0*(UG(I+1)-UG(I-1))/(XS(I+1)-XS(I-1))
      K(I)=VISCG(I)*DUDX(I)/(UG(I)*UG(I))
   28 REX(I)=UG(I)*XS(I)/(12.0*VISCG(I))
C
C VI. DETERMINATION OF PLATE TEMPERATURES AND MASS INJECTION RATES
C
      DO 34 J=1,24
      TO(J)=A+B*SQRT(C+D*EO(J))
      TAVG(J)=TO(J)+49.97-12.6E-04*TO(J)-32.0E-06*TO(J)*TO(J)
      MDOT(J)=0.0
      IF(CM(J).LE.0.0) GO TO 84
      IF(J.EQ.NPLATE) CMFLG=1.0-CMFLG
      IF(CMFLG.LE.0.0) GO TO 29
C
C   LARGE ROTAMETERS: NEW FIT FOR FACTORY CALIBRATION PLUS/MINUS 0.3%
      WSTDJ=(0.60+0.752*CM(J)-0.50*SIN(CM(J)*3.1417/25.0))*0.075/60.0
C
      GO TO 30
C
C   SMALL ROTAMETERS: NEW FIT FOR FACTORY CALIBRATION PLUS/MINUS 0.3%
   29 WSTDJ=(0.175+0.13091*CM(J)-0.067*SIN((CM(J)-2.0)*3.1417/21.0))*
     10.075/60.0
C
   30 WSTD(J)=WSTDJ
C
C   ROTAMETER FLOW CORRECTED FOR DENSITY TO YIELD ACTUAL FLOW, THEN
C   CORRECTED FOR PLATE POROSITY VARIATION
C
      WACT(J)=WSTD(J)*SQRT((PROTAB/(RM*TROTA*0.075)))
      IF(PROT.GT.-0.01) MDOT(J)=WACT(J)*(KFLOW(J)+KFUDGE(J))*2.01258
      IF(PROT.LE.-0.01) MDOT(J)=-WACT(J)*(KFLOW(J))*2.01258
C
   84 JI=2*J-1
      RHOZRO(J)=(PAMB+5.20*PO(JI))/(RM*(TAVG(J)+460.0))
      F(J)=MDOT(J)/(UG(JI)*RHOG(JI))
   34 VZERO(J)=MDOT(J)/RHOZRO(J)
```

```
C
C VII. CALCULATION OF PROFILE VELOCITIES AND ASSOCIATED PARAMETERS
C
      DO 38 M=1,S
      NP=NPREF(M)
      IF(X(M).GE.XS(NP)) DDP(M)=-(PO(NP+1)-PO(NP))*(X(M)-XS(NP))/
     1(XS(NP+1)-XS(NP))
      IF(X(M).LT.XS(NP)) DDP(M)=(PO(NP)-PO(NP-1))*(XS(NP)-X(M))/
     1(XS(NP)-XS(NP-1))
      YO(M)=Y(M,1)
      IF(X(M).GE.XS(NP)) RHOU=RHOG(NP)+(RHOG(NP+1)-RHOG(NP))*(X(M)-XS(NP
     1))/(XS(NP+1)-XS(NP))
      IF(X(M).LT.XS(NP)) RHOU=RHOG(NP-1)+(RHOG(NP)-RHOG(NP-1))*(X(M)-
     1XS(NP-1))/(XS(NP)-XS(NP-1))
      UGG(M)=SQRT((64.34*(PINF(M)+DDP(M))*(62.4*CH2O/RHOU)/12.0))
      IF(X(M).GE.XS(NP)) KM(M)=K(NP)+(K(NP+1)-K(NP))*(X(M)-XS(NP))/
     1(XS(NP+1)-XS(NP))
      IF(X(M).LT.XS(NP)) KM(M)=K(NP-1)+(K(NP)-K(NP-1))*(X(M)-XS(NP-1))/
     1(XS(NP)-XS(NP-1))
      DO 600 JI=1,24
      XJI=JI
      XPLD=4.0*XJI
      IF(X(M).LT.XPLD) GO TO 601
  600 CONTINUE
  601 MDOTM(M)=MDOT(JI)
      VZEROM(M)=VZERO(JI)
      FM(M)=MDOTM(M)/(RHOU*UGG(M))
C
C   A: ABSOLUTE VELOCITIES AND ASSOCIATED PARAMETERS
C
      DP=Z(M)
      DO 33 R=1,DP
      P(M,R)=P(M,R)+DDP(M)
      U(M,R)=SQRT((64.34*P(M,R)*(62.4*CH2O/RHOU)/12.0))
C
C   TOTAL HEAD READINGS CORRECTED FOR VISCOUS EFFECTS
C
      VISC(M)=(11.0+0.0175*TG)/(1000000.0*RHOU)
      REP=U(M,R)*RAD/(12.0*VISC(M))
      CP2=1.000
      IF(REP.GT.100.0) GO TO 61
      REP1=REP
      IF(P(M,R).LE.0.001) GO TO 61
   31 CP1=1.020-0.566/SQRT(REP1)+3.530/REP1
      REP1=REP/SQRT(CP1)
      CP2=1.020-0.566/SQRT(REP1)+3.530/REP1
      REP1=REP/SQRT(CP2)
      DCP=CP2-CP1
      IF(DCP.GT.0.01) GO TO 31
   61 U(M,R)=U(M,R)/SQRT(CP2)
C
      UUG(M,R)=U(M,R)/UGG(M)
      Y(M,R)=Y(M,R)-YO(M)+OD(M)/2.0
C
C   DISPLACEMENT, MOMENTUM, AND BOUNDARY LAYER THICKNESSES CALCULATED
C
      IF(R.LE.1) GO TO 40
      IF(UUG(M,R).GE.0.97.AND.UUG(M,R).LE.0.99) DEL1(M)=Y(M,R)
      IF(UUG(M,R).GE.0.97.AND.UUG(M,R).LE.0.99) DEE1(M)=1.0-UUG(M,R)
      IF(UUG(M,R).GE.0.99.AND.UUG(M,R-1).LE.0.99) DEL2(M)=Y(M,R)
      IF(UUG(M,R).GE.0.99.AND.UUG(M,R-1).LE.0.99) DEE2(M)=1.0-UUG(M,R)
      IF(R.GT.1) GO TO 32
   40 SUM1(M,R)=UUG(M,R)*Y(M,R)/2.0
      SUM2(M,R)=UUG(M,R)*UUG(M,R)*Y(M,R)/2.0
      GO TO 33
   32 SUM1(M,R)=SUM1(M,R-1)+(UUG(M,R)+UUG(M,R-1))*(Y(M,R)-Y(M,R-1))/2.0
      SUM2(M,R)=SUM2(M,R-1)+(UUG(M,R)*UUG(M,R)+UUG(M,R-1)*UUG(M,R-1))*
     1(Y(M,R)-Y(M,R-1))/2.0
   33 CONTINUE
      DEL(M)=DEL1(M)+(DEL2(M)-DEL1(M))*(DEE1(M)-0.010)/(DEE1(M)-DEE2(M))
      DELT1(M)=Y(M,DP)-SUM1(M,DP)
      DELT2(M)=SUM1(M,DP)-SUM2(M,DP)
      H(M)=DELT1(M)/DELT2(M)
C
      REDEL2(M)=UGG(M)*DELT2(M)/(VISC(M)*12.0)
      REXUGG(M)=UGG(M)*X(M)/(VISC(M)*12.0)
      DO 90 R=1,DP
   90 YDEL(M,R)=Y(M,R)/DEL(M)
```

```
C
C   B: DETERMINATION OF CF/2
C
C        CALCULATION OF CF2MI
C
      CF2MI(M)=0.0
      IF(CFFLAG(M).GT.0.0) CF2MI(M)=REDEL2(M)*(H(M)+1.0)*KM(M)-FM(M)
C
C        CALCULATION OF CF2SL AND CF2SL2
C
      IF(MOOTM(M).LT.0.0001.AND.MOOTM(M).GT.-0.0001) GO TO 35
      CF2SL(M)=KM(M)/FM(M)+(FM(M)*UUG(M,1)-KM(M)*REXUGG(M)*Y(M,1)/X(M))
     1/(EXP(FM(M)*REXUGG(M)*Y(M,1)/X(M))-1.0)
      CF2SL2(M)=KM(M)/FM(M)+(FM(M)*UUG(M,2)-KM(M)*REXUGG(M)*Y(M,2)/X(M))
     1/(EXP(FM(M)*REXUGG(M)*Y(M,2)/X(M))-1.0)
      GO TO 36
   35 CF2SL(M)=UUG(M,1)/(REXUGG(M)*Y(M,1)/X(M))+0.5*KM(M)*REXUGG(M)*
     1Y(M,1)/X(M)
      CF2SL2(M)=UUG(M,2)/(REXUGG(M)*Y(M,2)/X(M))+0.5*KM(M)*REXUGG(M)*
     1Y(M,2)/X(M)
   36 CONTINUE
   38 CONTINUE
C
C        CALCULATION OF CFMICR
C
      CFFLAG(S+1)=0.0
      DO 2001 M=1,S
      IF(CFFLAG(M).LE.0.0) CFCORR(M)=0.0
      IF(CFFLAG(M).LE.0.0) GO TO 2000
      IF(CFFLAG(M+1).LE.0.0) GO TO 1000
      CFCORR(M)=REDEL2(M)*((ALOG(REDEL2(M))-ALOG(REDEL2(M+1)))/(REXUGG(M
     1)-REXUGG(M+1)))*(REXUGG(M)*KM(M)+1.0)
      GO TO 2000
 1000 IF(M.EQ.1) CFCORR(M)=0.0
      IF(M.EQ.1) GO TO 2000
      IF(CFFLAG(M-1).LE.0.0) CFCORR(M)=0.0
      IF(CFFLAG(M-1).LE.0.0) GO TO 2000
      CFCORR(M)=REDEL2(M)*((ALOG(REDEL2(M-1))-ALOG(REDEL2(M)))/(REXUGG(M
     1-1)-REXUGG(M)))*(REXUGG(M)*KM(M)+1.0)
 2000 CONTINUE
 2001 CFMICR(M)=CF2MI(M)+CFCORR(M)
C
C   C: DETERMINATION OF CORRESPONDING VALUES OF U+, Y+, P+, AND VO+
C
      DO 3001 M=1,S
      VPLUS1(M)=FM(M)/SQRT(CF2SL(M))
      PPLUS1(M)=-1.0*KM(M)/(CF2SL(M)*SQRT(CF2SL(M)))
      VPLUS2(M)=0.0
      PPLUS2(M)=0.0
      IF(CF2MI(M).GT.0.0) VPLUS2(M)=FM(M)/SQRT(CFMICR(M))
      IF(CF2MI(M).GT.0.0) PPLUS2(M)=-1.0*KM(M)/(CFMICR(M)*SQRT(CFMICR(M)
     1))
      DP=Z(M)
      DO 37 R=1,DP
      UPLUS1(M,R)=UUG(M,R)/SQRT(CF2SL(M))
      YPLUS1(M,R)=Y(M,R)*REXUGG(M)*SQRT(CF2SL(M))/X(M)
      UPLUS2(M,R)=0.0
      YPLUS2(M,R)=0.0
      IF(CF2MI(M).GT.0.0) UPLUS2(M,R)=UUG(M,R)/SQRT(CFMICR(M))
      IF(CF2MI(M).GT.0.0) YPLUS2(M,R)=Y(M,R)*REXUGG(M)*SQRT(CFMICR(M))/
     1X(M)
   37 CONTINUE
 3001 CONTINUE
```

```
C
C VIII. PRINTING OF CALCULATED QUANTITIES
C
C    A. SETUP DATA
C
      WRITE(6,3)
   56 FORMAT(7X,12HRUN NUMBER: ,I6,1H-,I1)
      WRITE(6,56) DATE,RUNNO
   57 FORMAT(//,11X,6HTGAS= ,F5.2,2H F,8X,6HRHUM= ,F4.2,8X,19HMDOT= LBM/
     1(SEC-FT2),//)
      WRITE(6,57) TG,RHUM
   58 FORMAT(77H      I      X(I)    TOAVG(I)      U(I)      DUDX(I)      K(I)
     1      MDOT(I)        F(I))
      WRITE(6,58)
      IJK=1
   89 FORMAT(9X,3HIN.,5X,7H(DEG F),4X,6HFT/SEC,4X,7H 1/SEC ,/)
      WRITE(6,89)
   59 FORMAT(3X,I2,3X,F5.2,4X,F5.2,6X,F6.2,4X,F6.3,3X,E10.3,3X,F7.4,4X,F
     18.5)
      WRITE(6,59) IJK,XS(IJK),TAVG(IJK),UG(IJK),DUDX(IJK),K(IJK),
     1MDOT(IJK),F(IJK)
      DO 81 I=1,23
      IJ=2*I
      IJK=IJ+1
      LK=(IJK+1)/2
   60 FORMAT(3X,I2,3X,F5.2,15X,F6.2,4X,F6.3,3X,E10.3)
      WRITE(6,60) IJ,XS(IJ),UG(IJ),DUDX(IJ),K(IJ)
      WRITE(6,59) IJK,XS(IJK),TAVG(LK),UG(IJK),DUDX(IJK),K(IJK),MDOT(LK
     1),F(LK)
   81 CONTINUE
      WRITE(6,3)
C
C    B. SUMMARY OF PROFILE PARAMETERS
C
   51 FORMAT(/////////,2X,17H      RUN NUMBER: ,I6,1H-,I1)
      WRITE(6,51) DATE,RUNNO
   52 FORMAT(//,112H      M      X          NREX          UGG          K            F
     1      DELT2     NREDELT2     H          DEL     CF2(SL)    CF2(MI,C))
      WRITE(6,52)
   53 FORMAT(10X,3HIN.,17X,6HFT/SEC,22X,3HIN.,25X,3HIN.,/)
      WRITE(6,53)
      DO 55 M=1,S
   54 FORMAT(5X,[illegible],F6.3,3X,E9.3,2X,F6.2,1X,E10.3,1X,F8.5,2X,F6.4,4X,
     1F6.1,3X,F5.3,4X,F5.3,3X,F7.5,3X,F7.5)
      WRITE(6,54) M,X(M),REXUGG(M),UGG(M),KM(M),FM(M),DELT2(M),REDEL2(M)
     1,H(M),DEL(M),CF2SL(M),CFMICR(M)
   55 CONTINUE
      WRITE(6,3)
      WRITE(6,51) DATE,RUNNO
 1005 FORMAT(//,111H      M      X          NREX          K          NREDELT2
     1 CF2(SL,1)    CF2(SL,2)     CF2(MI,A)       CORR.       CF2(MI,C))
      WRITE(6,1005)
 1006 FORMAT(13H            IN.,/)
      WRITE(6,1006)
 1007 FORMAT(4X,I2,3X,F6.3,2X,E9.3,2X,E10.3,4X,F7.1,5X,F7.5,5X,F7.5,6X,
     1F7.5,4X,F8.5,5X,F7.5)
      DO 1008 M=1,S
      WRITE(6,1007) M,X(M),REXUGG(M),KM(M),REDEL2(M),CF2SL(M),CF2SL2(M),
     1CF2MI(M),CFCORR(M),CFMICR(M)
 1008 CONTINUE
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C
C    C: INDIVIDUAL PROFILE DATA
C
      DO 70 M=1,S
      WRITE(6,3)
      WRITE(6,56) DATE,RUNNO
   75 FORMAT(3H    )
      WRITE(6,75)
   62 FORMAT(5X,3HM= ,I1,3X,3HX= ,F6.3,4H IN.,3X.5HUGG= ,F6.2,7H FT/SEC,
     18X,7HDELT2= ,F6.4,4H IN.,3X,9HCF2(SL)= ,F7.5,5X,11HPPLUS(SL)= ,F8.
     25)
      WRITE(6,62) M,X(M),UGG(M),DELT2(M),CF2SL(M),PPLUS1(M)
   63 FORMAT(12X,3HK= ,E10.3,3X,6HMDOT= ,F7.4,13H LBM/FT2-SEC ,10HNREDEL
     1T2= ,F6.1,4X,9HCF2(MI)= ,F7.5,5X,15HVZEROPLUS(SL)= ,F8.5)
      WRITE(6,63) KM(M),MDOTM(M),REDEL2(M),CF2MI(M),VPLUS1(M)
   64 FORMAT(12X,3HF= ,F8.5,5X,7HVZERO= ,F8.5,7H FT/SEC,4X,3HH= ,F5.3,12
     1X,10HCF2(MIC)= ,F7.5,4X,13HPPLUS(MI,C)= ,F8.5)
      WRITE(6,64) FM(M),VZEROM(M),H(M),CFMICR(M),PPLUS2(M)
   65 FORMAT(28X,6HNREX= ,E9.3,11X,5HDEL= ,F5.3,31X,17HVZEROPLUS(MI,C)=
     1,F8.5,//)
      WRITE(6,65) REXUGG(M),DEL(M),VPLUS2(M)
   66 FORMAT(5X,110H R          Y          U            YDEL       UUG          YPLUS
     1(SL)  UPLUS(SL)     YPLUS(MI)  UPLUS(MI)        SUM1        SUM2)
      WRITE(6,66)
  671 FORMAT(13X,3HIN.,4X,6HFT/SEC,51X,7H(CORR.),4X,7H(CORR.),7X,3HIN.,7
     1X,3HIN.)
      WRITE(6,671)
      WRITE(6,75)
      DP=Z(M)
      ISKIP=5
      DO 69 R=1,DP
   68 FORMAT(5X,I2,4X,F6.4,3X,F6.2,6X,F6.4,3X,F6.4,6X,F7.2,4X,F5.2,8X,F7
     1.2,4X,F5.2,7X,F7.5,3X,F7.5)
      WRITE(6,68) R,Y(M,R),U(M,R),YDEL(M,R),UUG(M,R),YPLUS1(M,R),UPLUS1
     1(M,R),YPLUS2(M,R),UPLUS2(M,R),SUM1(M,R),SUM2(M,R)
      IF(R.LT.ISKIP) GO TO 69
      WRITE(6,75)
      ISKIP=ISKIP+5
   69 CONTINUE
   70 CONTINUE
      WRITE(6,3)
C
C IX. PUNCHING OF CALCULATED QUANTITIES
C
  200 FORMAT(I6,1X,I1,1X,I1,1X,F6.3,E10.3  ,1X,F8.5,1X,F6.2,1X,F7.4,1X,F
     18.5,1X,E9.3)
  204 FORMAT(F6.4,1X,F6.1,1X,F5.3,1X,F5.3)
  205 FORMAT(F7.5,1X,F8.5,1X,F8.5,1X,F7.5,1X,F8.5,1X,F8.5)
 2011 FORMAT(F7.5,1X,F8.5,1X,F7.5,1X,F3.0)
  201 FORMAT(I2,1X,F6.4,1X,F6.2,1X,F6.4,1X,F6.4,1X,F7.2,1X,F5.2,1X,F7.2,
     11X,F5.2,1X,F7.5,1X,F7.5)
      DO 203 M=1,S
      PUNCH 200, DATE,RUNNO,M,X(M),KM(M),FM(M),UGG(M),MDOTM(M),VZEROM(M)
     1,REXUGG(M)
      PUNCH 204, DELT2(M),REDEL2(M),H(M),DEL(M)
      PUNCH 205, CF2SL(M),PPLUS1(M),VPLUS1(M),CF2MI(M),PPLUS2(M),VPLUS2(
     1M)
      IF(CF2MI(M).EQ.0.0)SFLAG(M)=0.0
      IF(CF2MI(M).NE.0.0) SFLAG(M)=1.0
      PUNCH 2011, CF2SL2(M),CFCORR(M),CFMICR(M),SFLAG(M)
      DP=Z(M)
      DO 202 R=1,DP
      PUNCH 201, R,Y(M,R),U(M,R),YDEL(M,R),UUG(M,R),YPLUS1(M,R),UPLUS1(M
     1,R),YPLUS2(M,R),UPLUS2(M,R),SUM1(M,R),SUM2(M,R)
  202 CONTINUE
  203 CONTINUE
C
      IF(RUNNO.LT.5) GO TO 2
      RETURN
      END
$DATA
```

APPENDIX C

SUMMARY OF SEMI-EMPIRICAL REPRESENTATIONS OF DATA

a) Assumed mixing length distributions:

i. Two-layer model

$y^+ < y_c^+$ $\qquad \ell = 0$

$y_c/\delta < y/\delta < \lambda/\kappa$ $\qquad \ell = \kappa y \quad (\kappa = 0.44)$

$y/\delta > \lambda/\kappa$ $\qquad \ell = \lambda\delta$

ii. Continuous modified Van Driest model

$y/\delta < \lambda/\kappa$ $\qquad \ell = \kappa y \left[1 - \exp\left(\frac{y^+\sqrt{\tau^+}}{A_*} \right) \right]$

$y/\delta > \lambda/\kappa$ $\qquad \ell = \lambda\delta$

b) Truncation of mixing length:

$$\lambda = 0.25 \, Re_{\delta_2}^{-1/8} \, (1-67.5 \, F)$$

where λ is truncated at a value of 0.085.

c) Shear stress distribution assumed in inner regions of layer:

$$\tau^+ = 1 + U^+V_w^+ + p^+y^+ \left[1 - \frac{1}{y} \int_0^y \left(\frac{U}{U_\infty} \right)^2 dy \right]$$

d) Correlation of $\tilde{y}_c^+ = y_c^+ \sqrt{\tau^+}$ and A_* with V_w^+ and p^+ :

$$\tilde{y}_c^+ = \tilde{y}_c^+\Big|_{p^+=0}[1 - Q_y(V_w^+)p^+]$$

$$A_* = A_*\Big|_{p^+=0}[1 - Q_*(V_w^+)p^+]$$

where

$$\tilde{y}_c^+\Big|_{p^+=0} = 11.0 - 18.0\ V_w^+$$

$$A_*\Big|_{p^+=0} = \begin{cases} 26.0 - 88.0\ V_w^+ + 110.0\ (V_w^+)^2 & V_w{}^+ \geq 0 \\ 26.0 - 88.0\ V_w^+ + 210.0\ (V_w^+)^2 & V_w{}^+ \leq 0 \end{cases}$$

and the functions $Q_y(V_w^+)$ and $Q_*(V_w^+)$ are given by

V_w^+	$Q_y(V_w^+)$	$Q_*(V_w^+)$
-0.08	63.3	203.0
0.0	19.7	45.0
0.005	18.0	39.6
0.01	16.6	35.7
0.015	15.7	32.2
0.02	15.0	29.8
0.025	14.5	27.1
0.03	14.1	24.9
0.035	13.8	23.1
0.04	13.6	22.0
0.045	13.4	20.9
0.05	13.2	20.0
0.06	12.8	19.0
0.4	3.2	3.4

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